US007472970B2

(12) **United States Patent**
Bergesch et al.

(10) **Patent No.: US 7,472,970 B2**
(45) **Date of Patent: Jan. 6, 2009**

(54) **EQUIPMENT ENCLOSURE KIT AND ASSEMBLY METHOD**

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(73) Assignee: **American Power Conversion Corporation**, West Kingston, RI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 360 days.

(21) Appl. No.: **11/107,001**

(22) Filed: **Apr. 15, 2005**

(65) **Prior Publication Data**

US 2006/0103270 A1 May 18, 2006

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/990,927, filed on Nov. 17, 2004, now Pat. No. 7,293,666.

(51) **Int. Cl.**
A47B 81/00 (2006.01)

(52) **U.S. Cl.** **312/223.1**; 211/26

(58) **Field of Classification Search** 248/224.8, 248/222.41, 223.21, 225.21; 312/265.1–265.4, 312/223.1, 223.6; 211/26; 174/100, 97, 174/68.1
See application file for complete search history.

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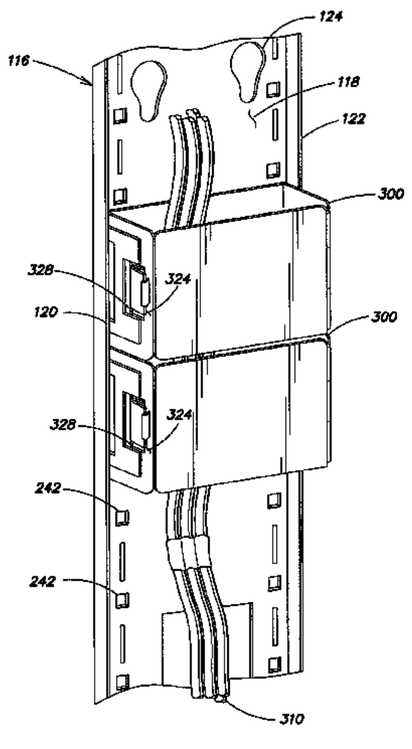
Primary Examiner—Janet M Wilkens
(74) *Attorney, Agent, or Firm*—Lowrie, Lando & Anastasi, LLP

(57) **ABSTRACT**

A containment bracket is disclosed for encasing a cable or wire within an enclosure designed to house electrical components. The containment bracket includes a housing having an interior region, the housing being attached to the enclosure. The containment bracket further includes a door coupled to the housing to access the interior region of the housing. A method for encasing a cable or wire within an enclosure designed to house electrical components is further disclosed.

4 Claims, 44 Drawing Sheets



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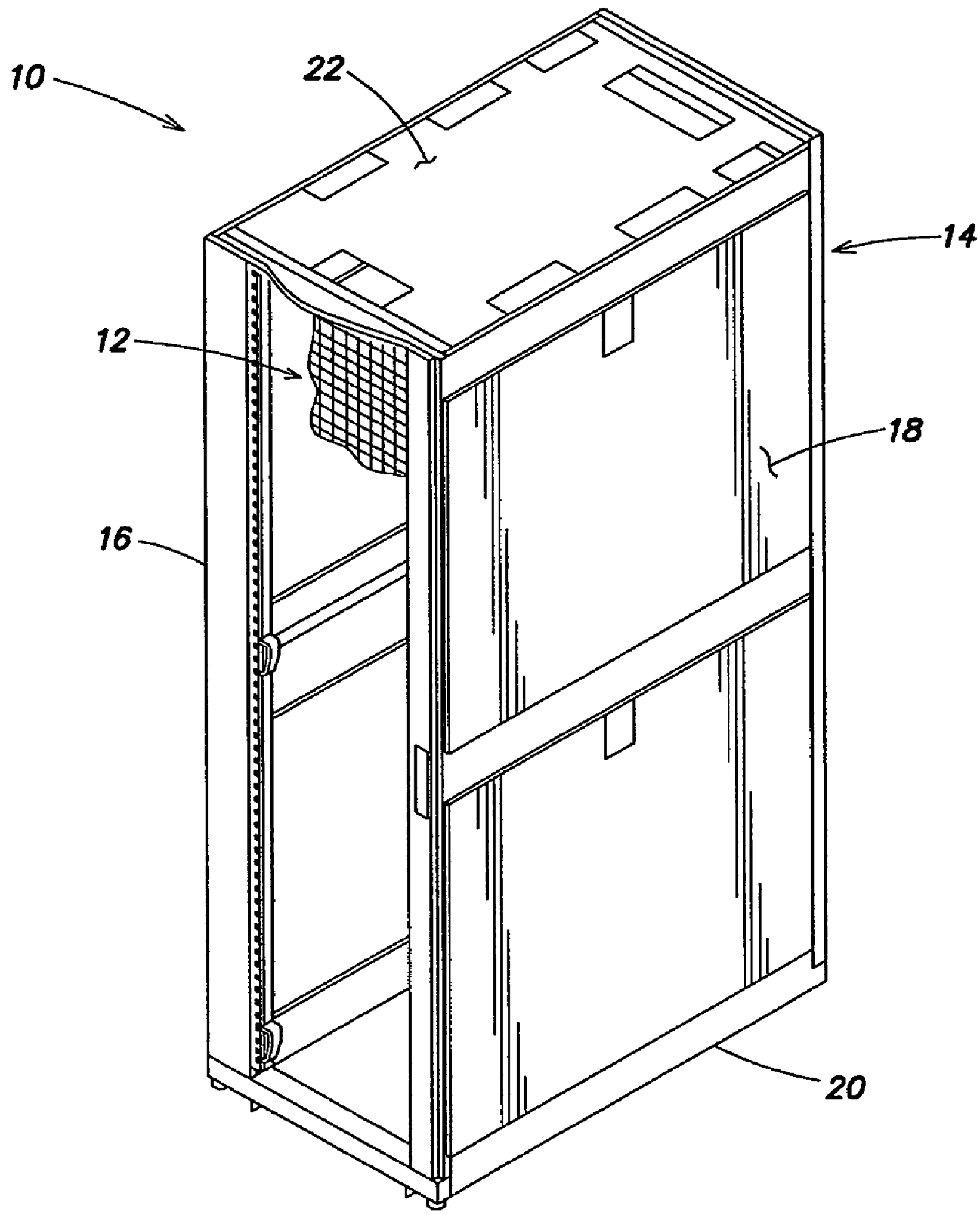


FIG. 1

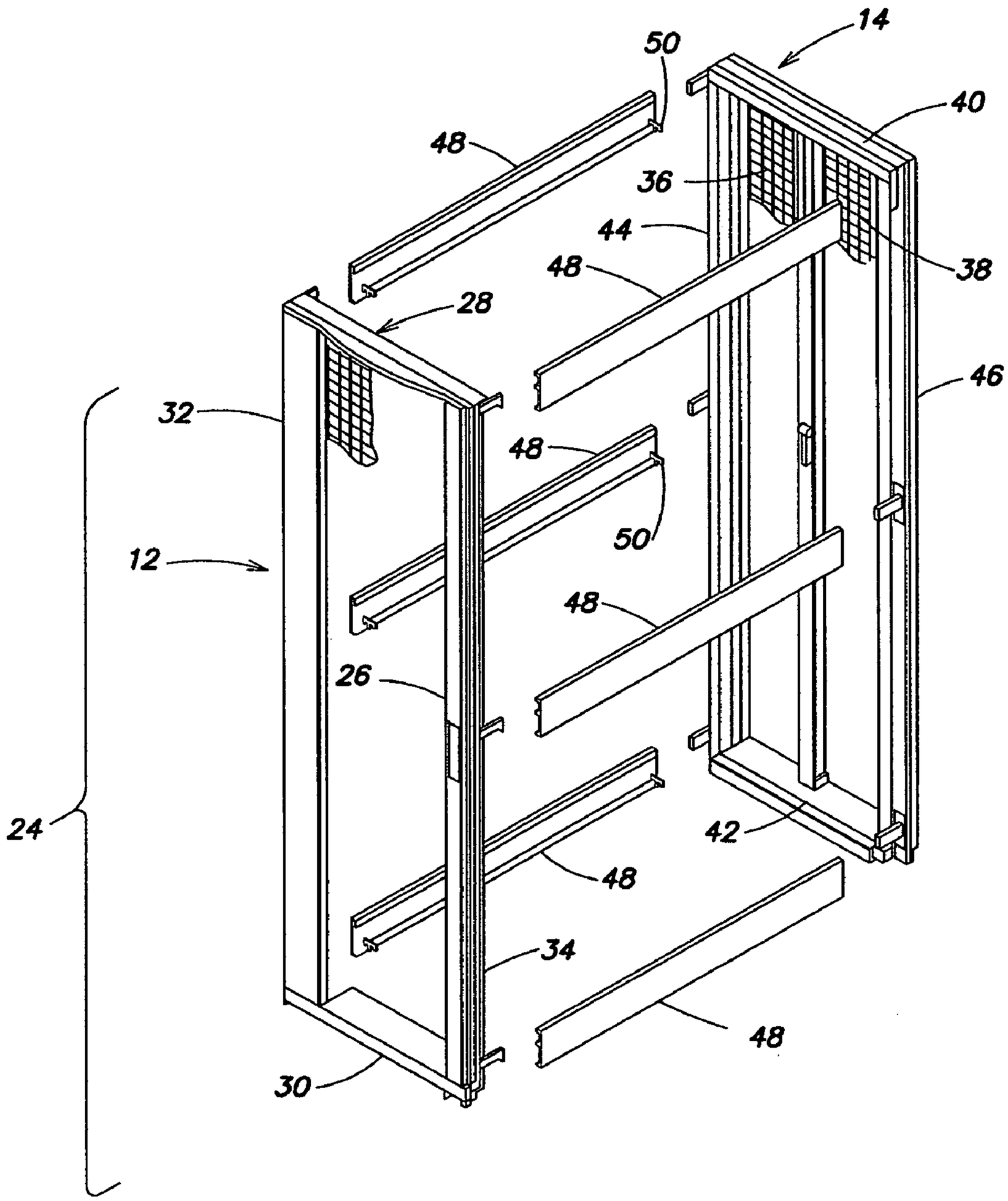


FIG. 2

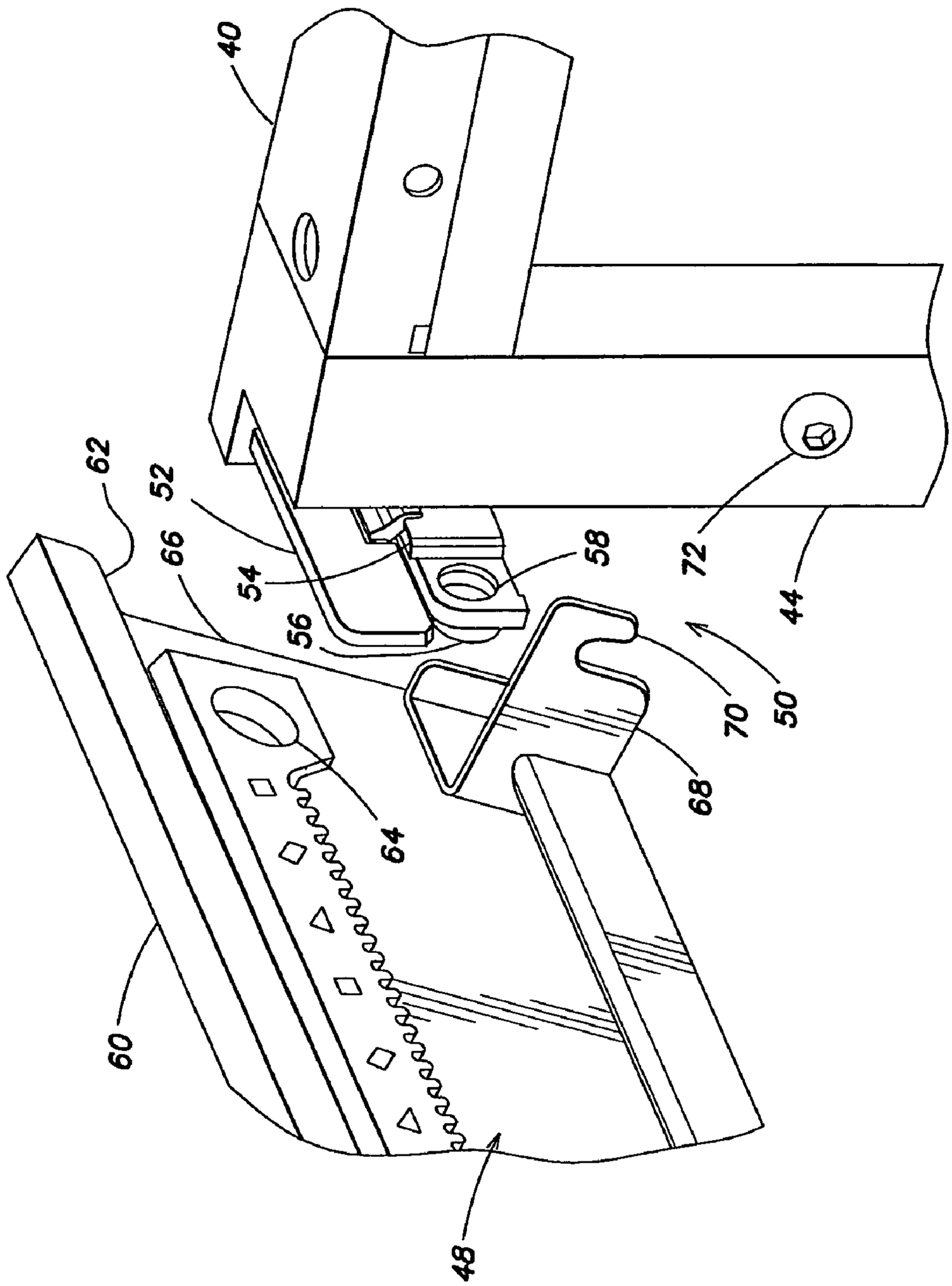
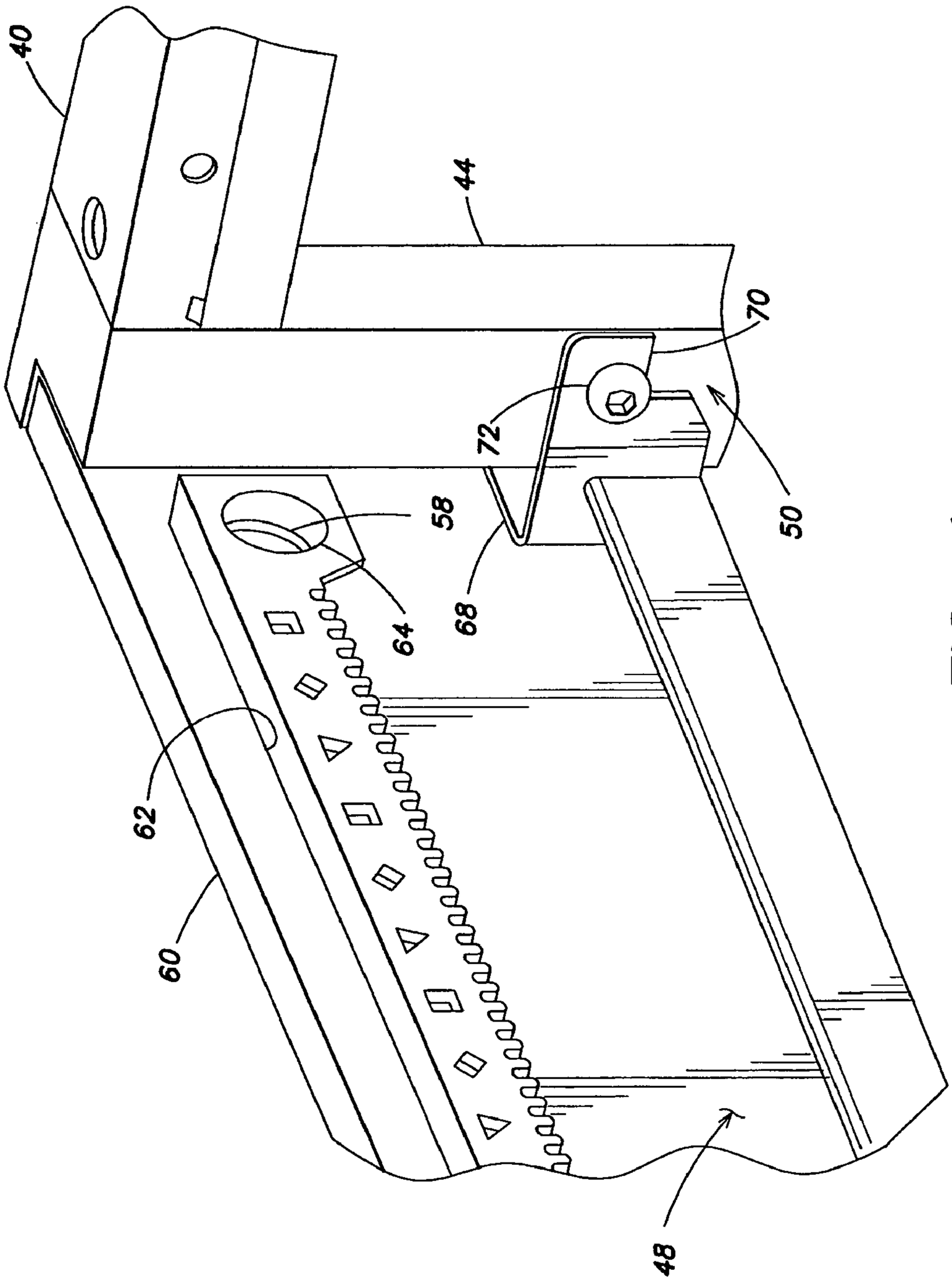


FIG. 3



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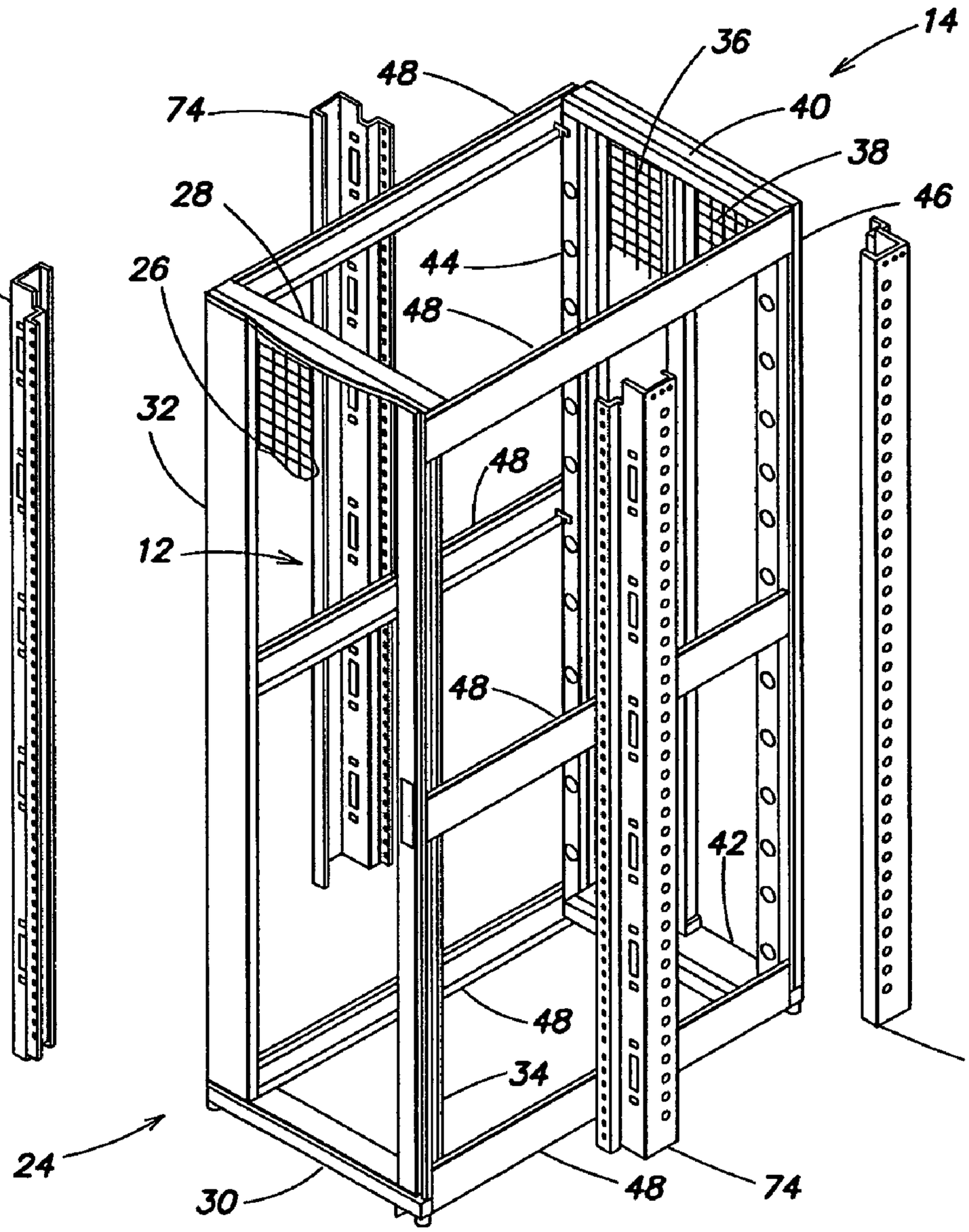


FIG. 5

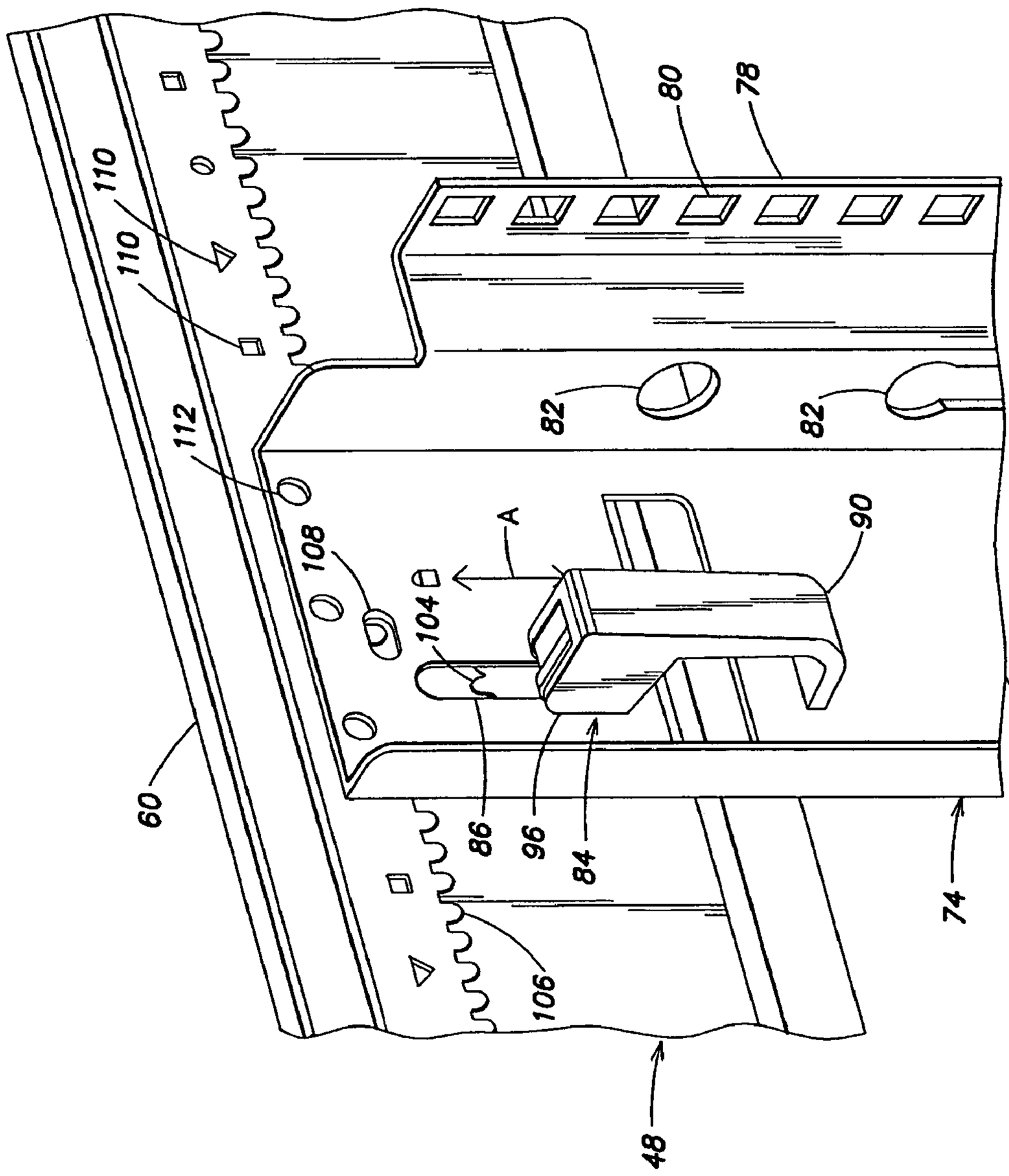
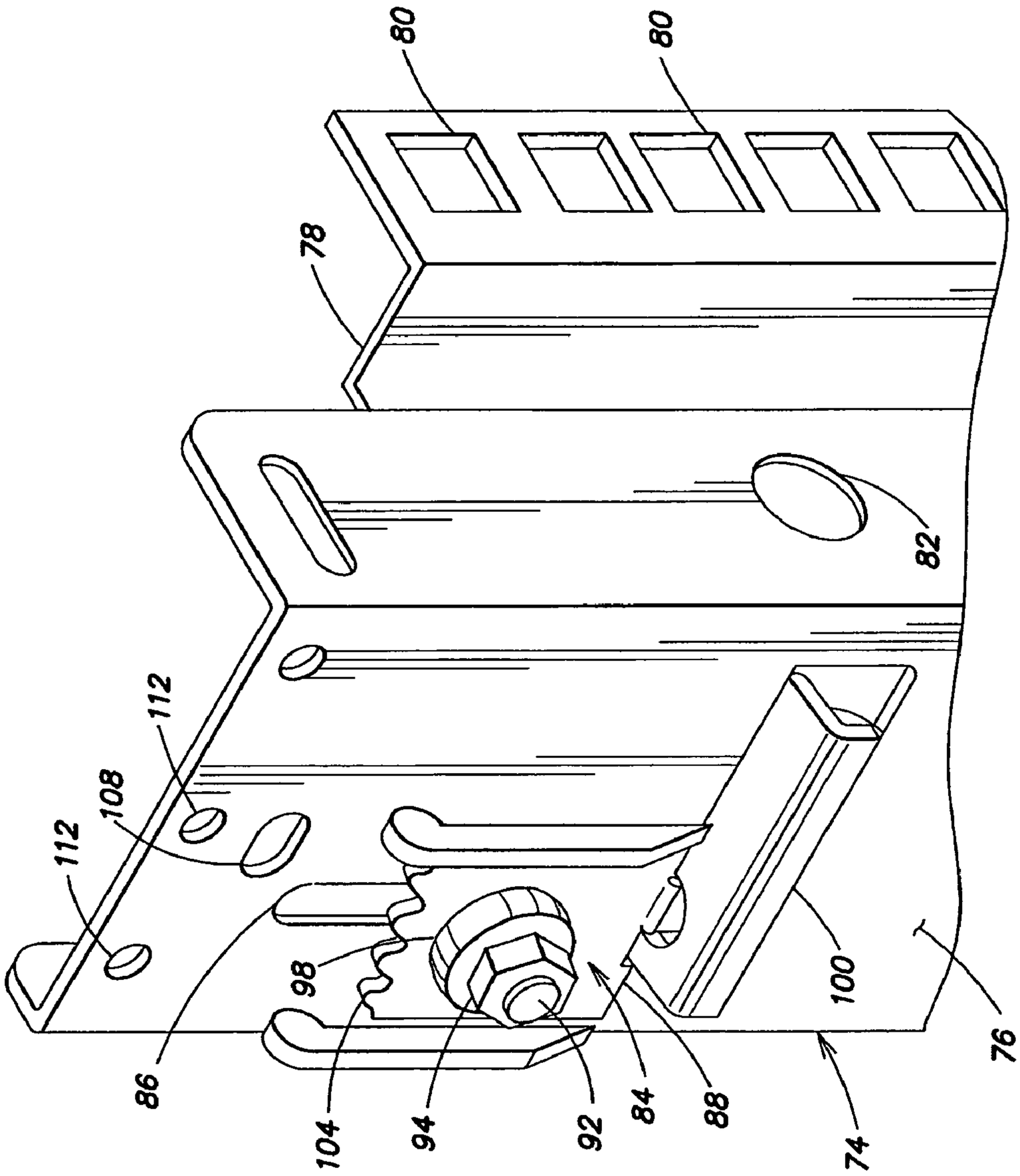


FIG. 6



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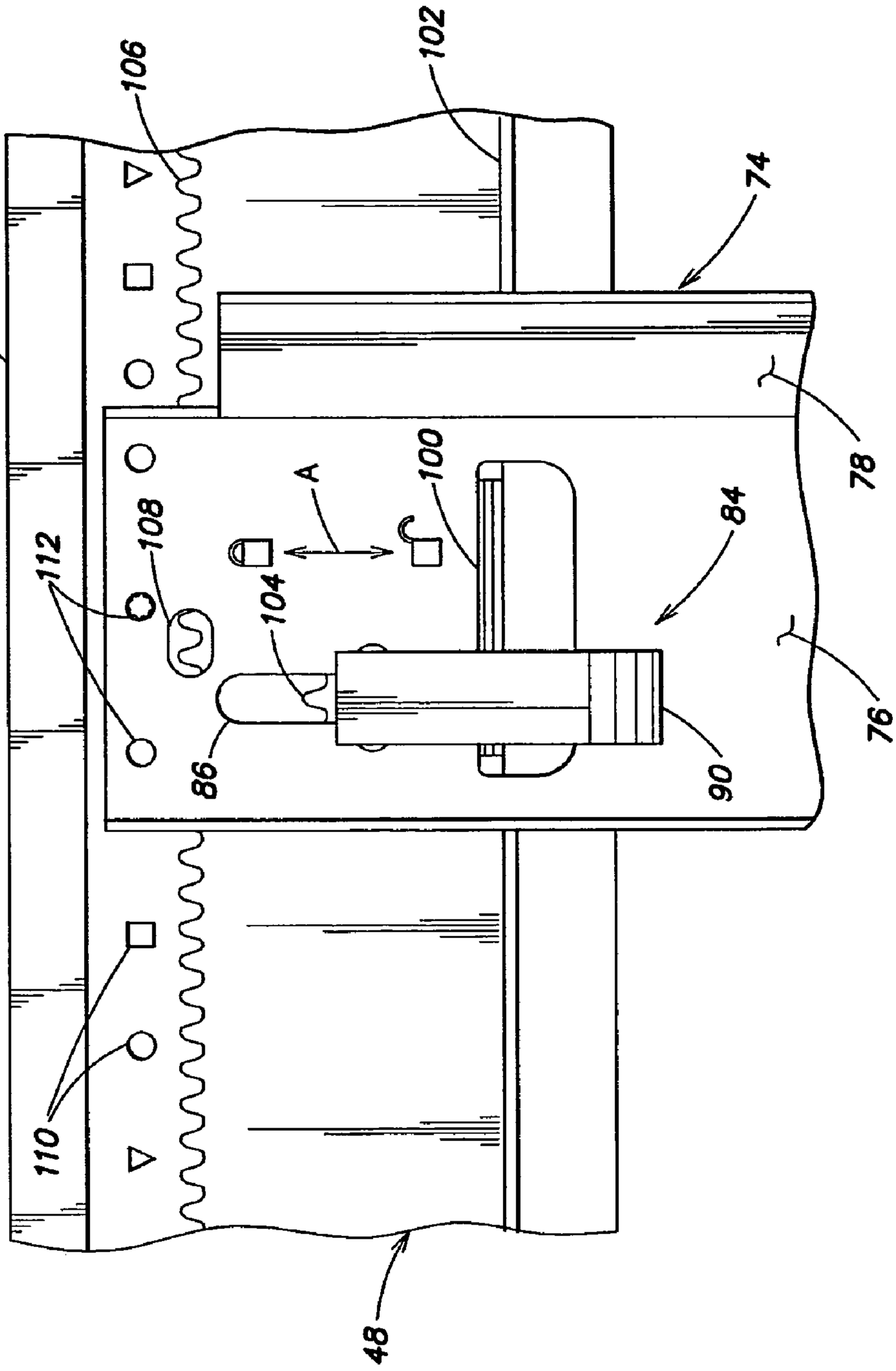

FIG. 8

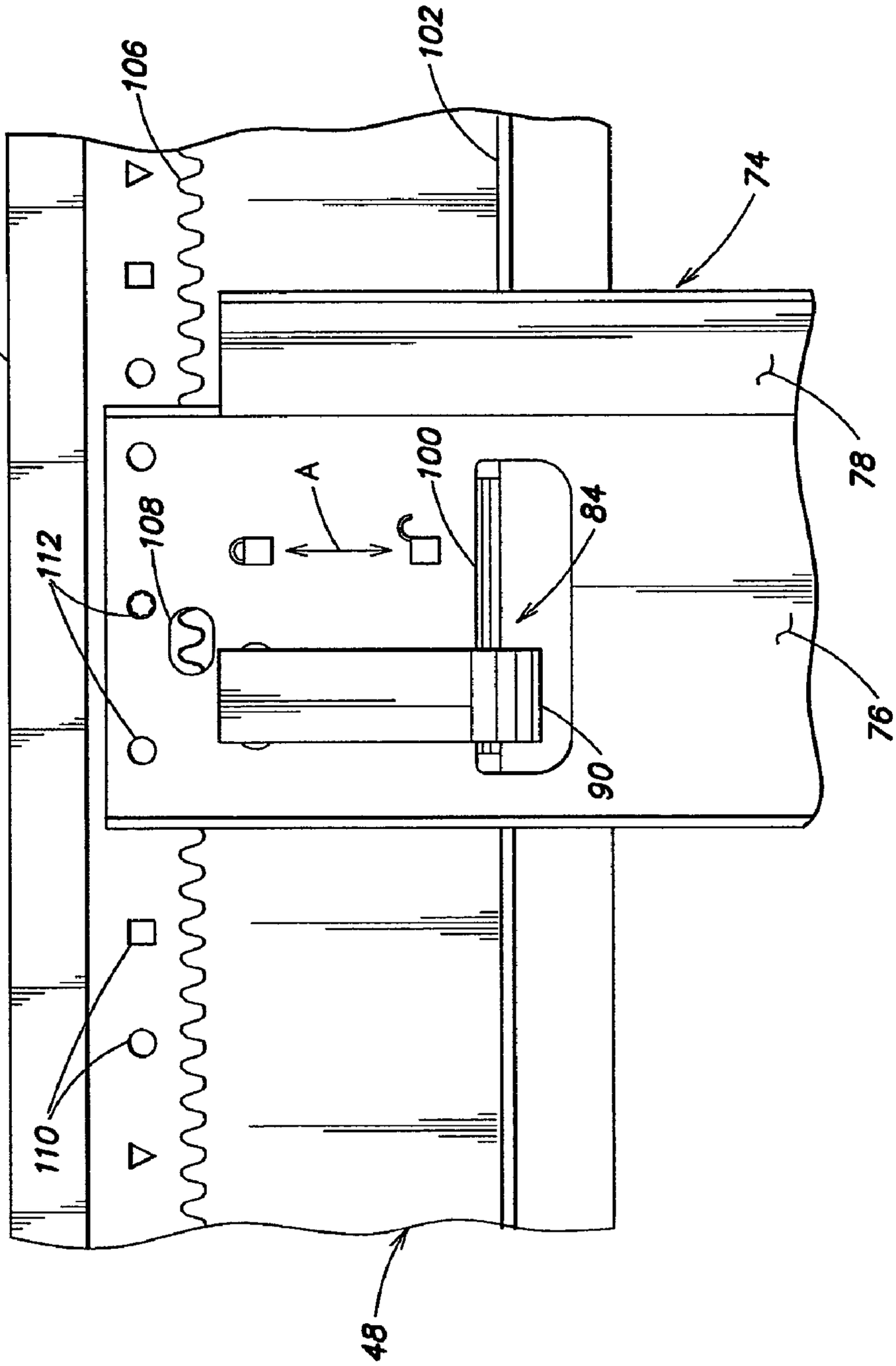

FIG. 9

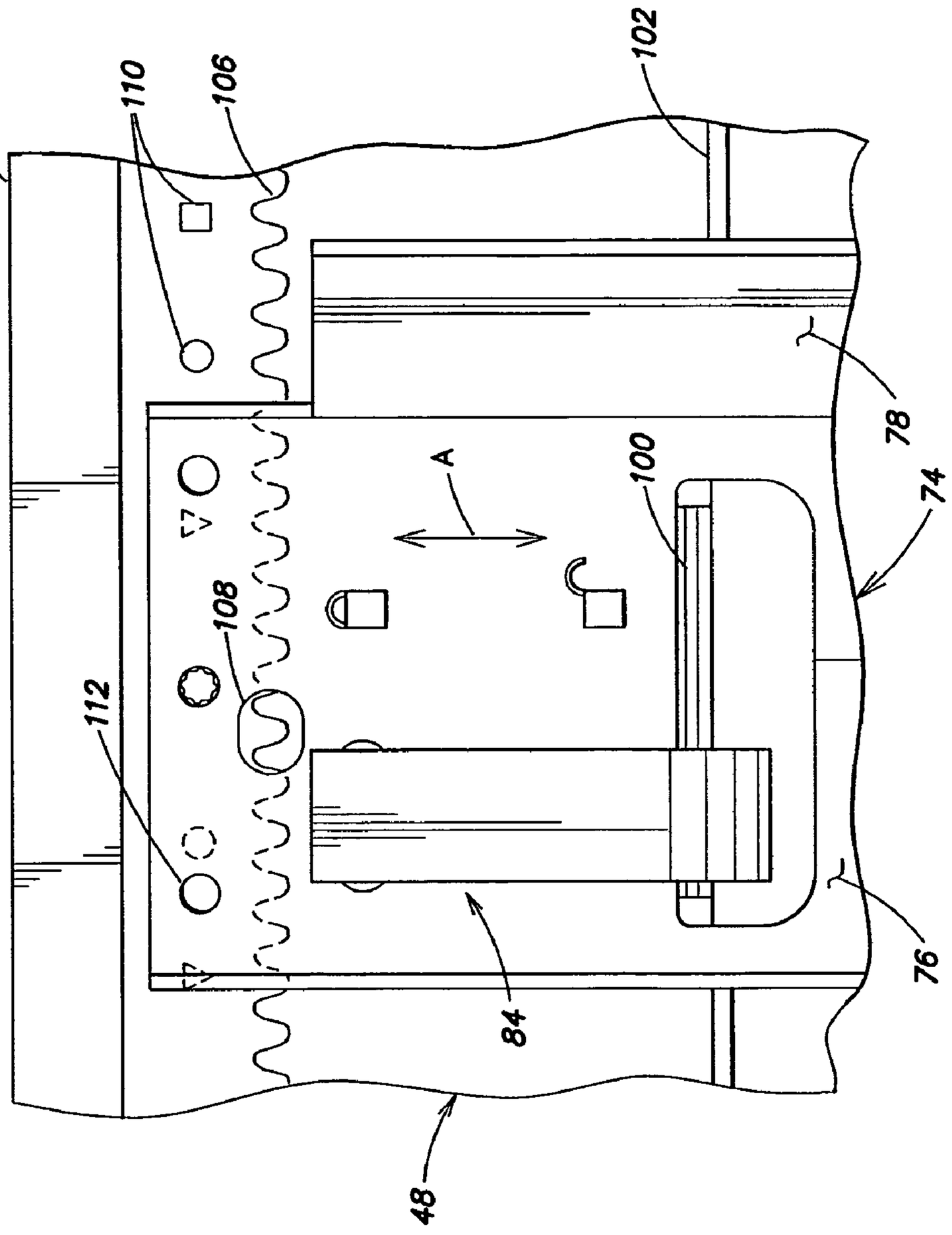

FIG. 10

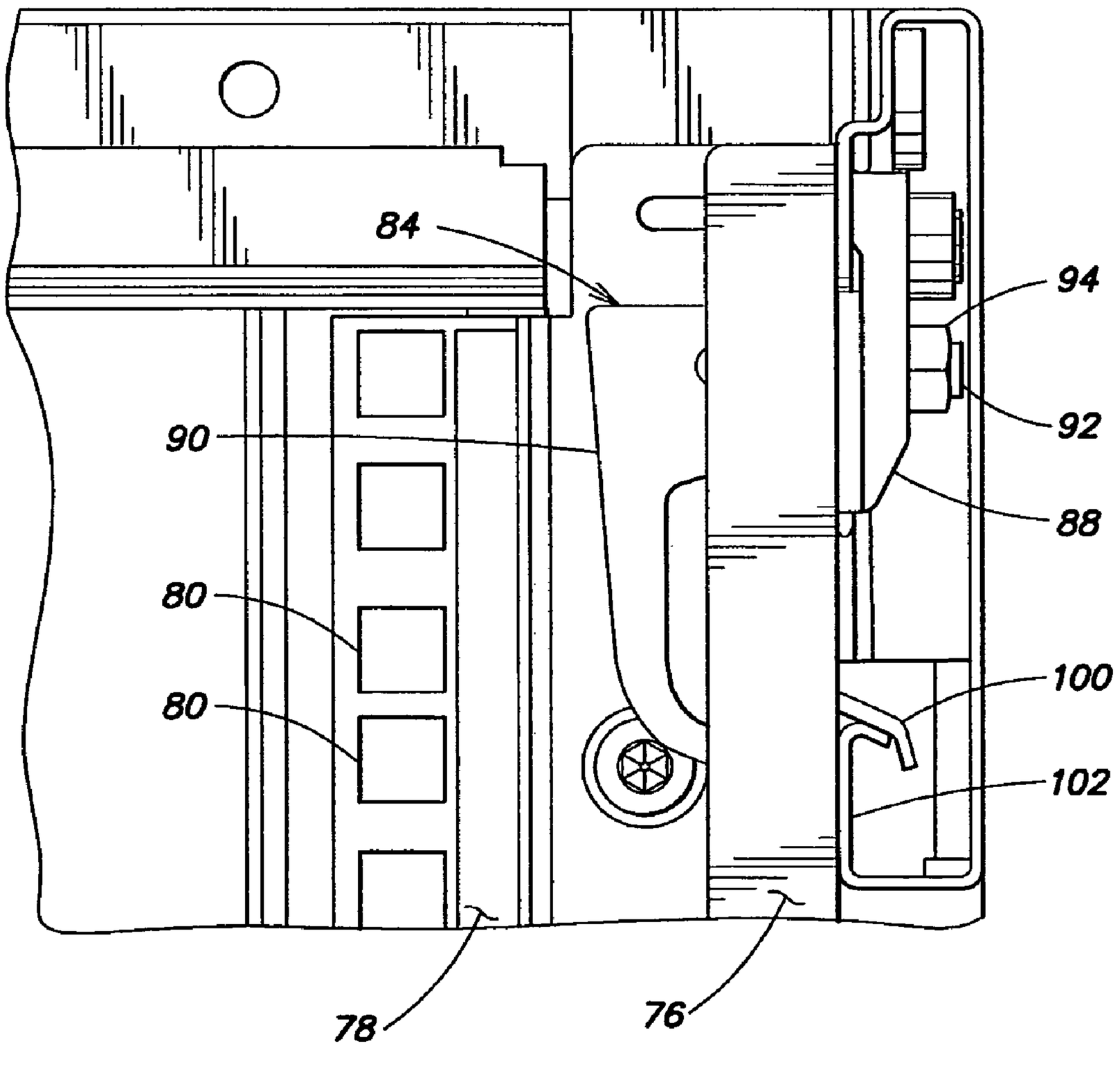

FIG. 11

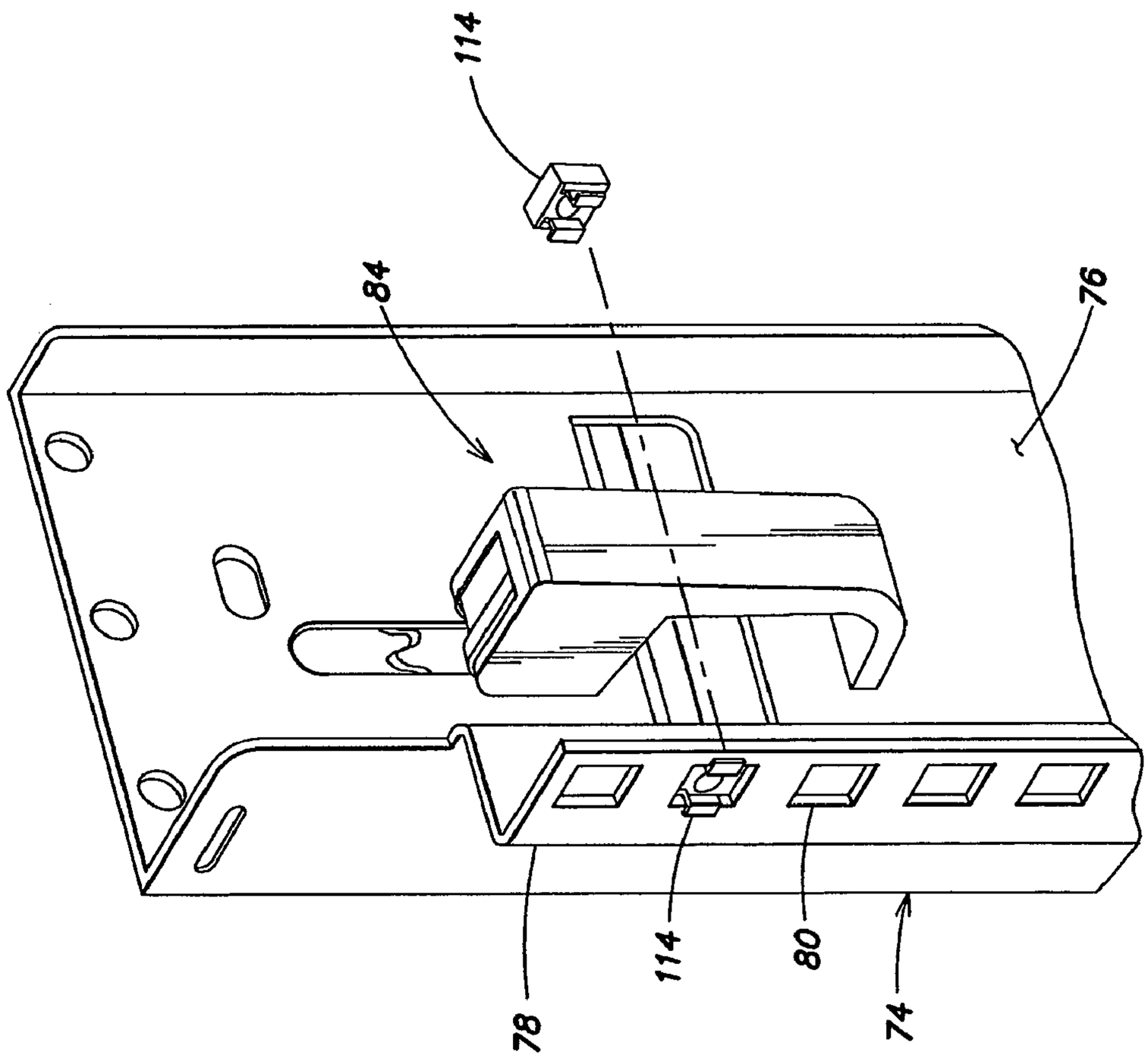

FIG. 11A

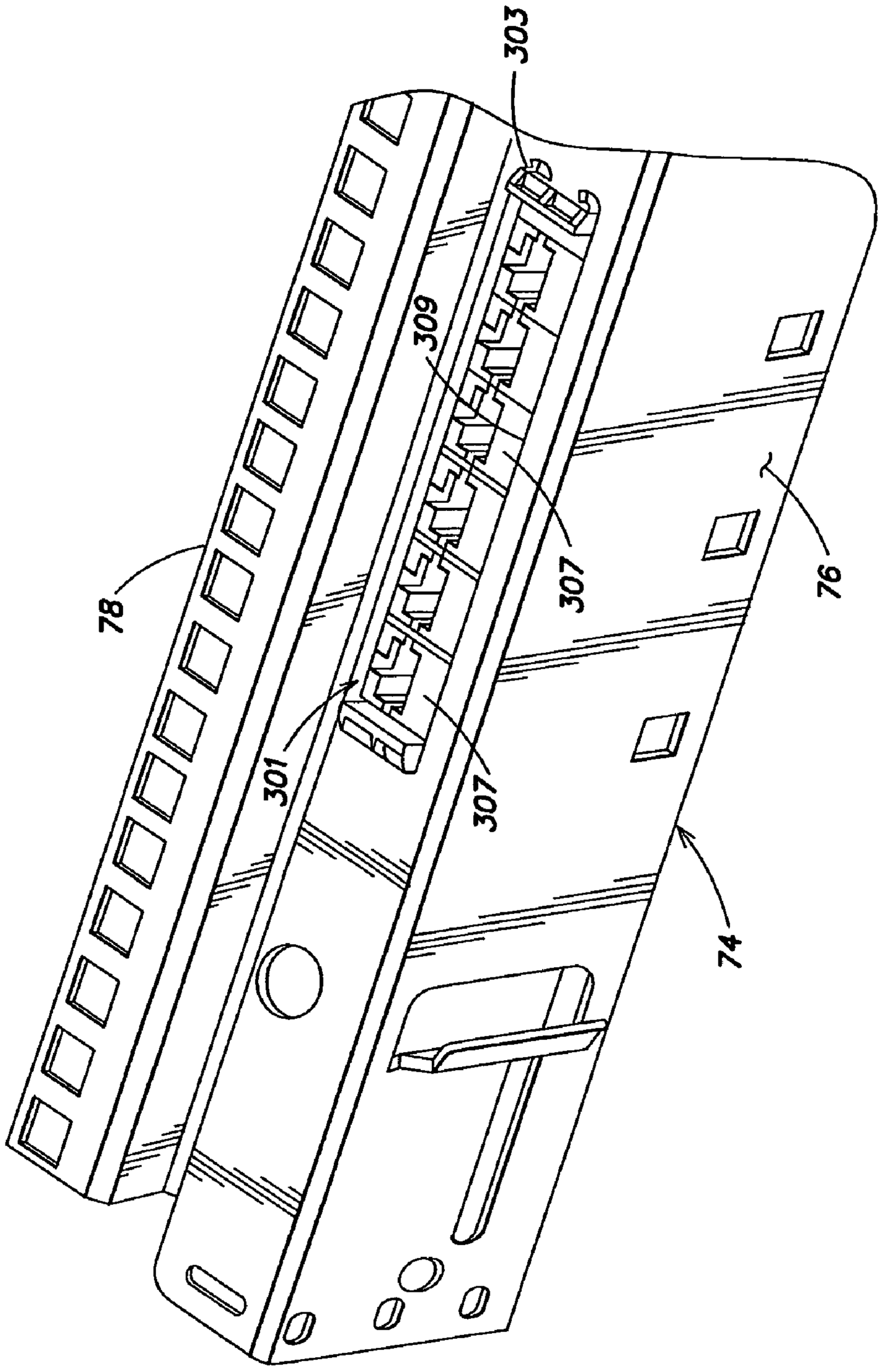

FIG. 11B

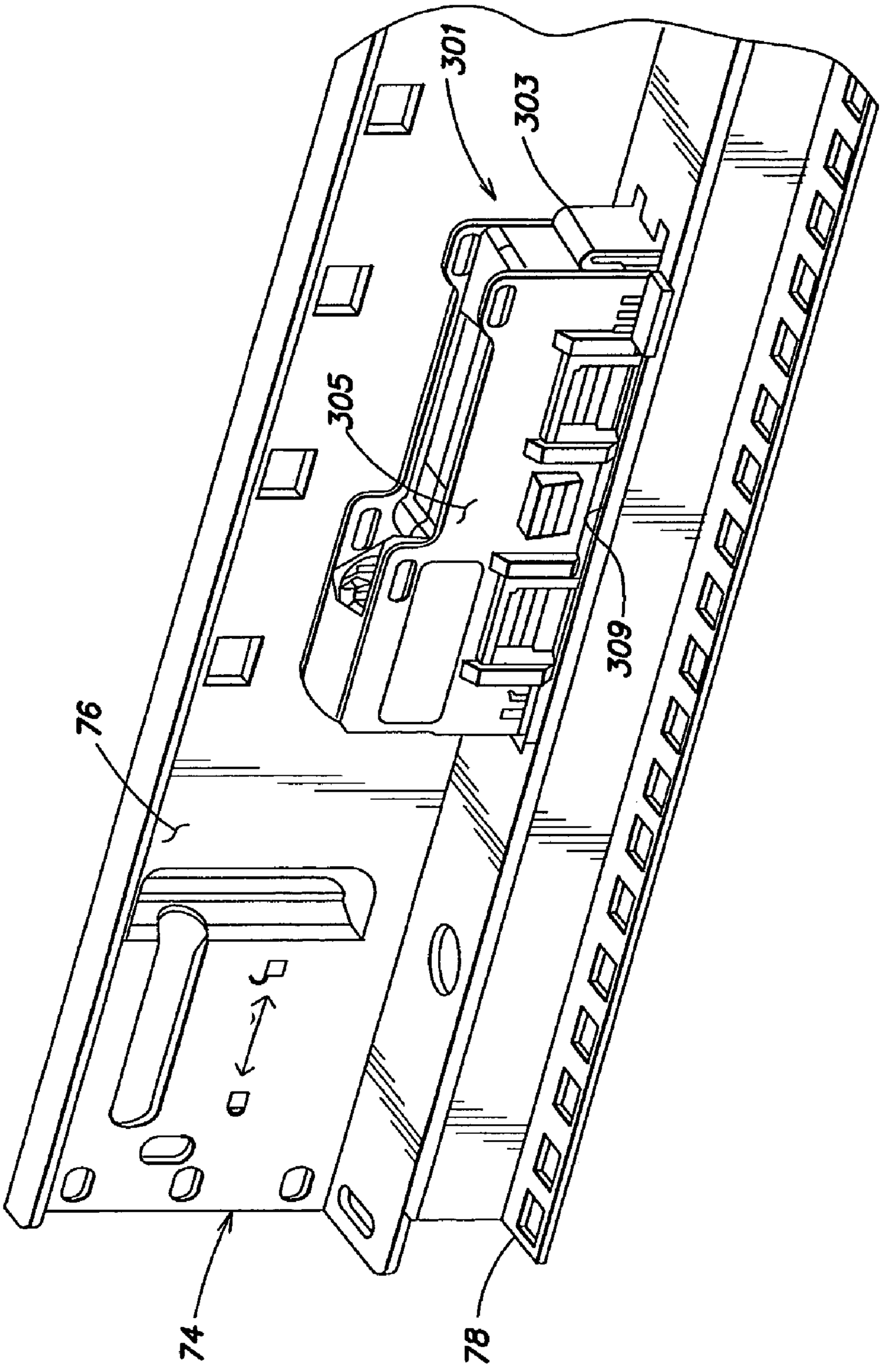

FIG. 11C

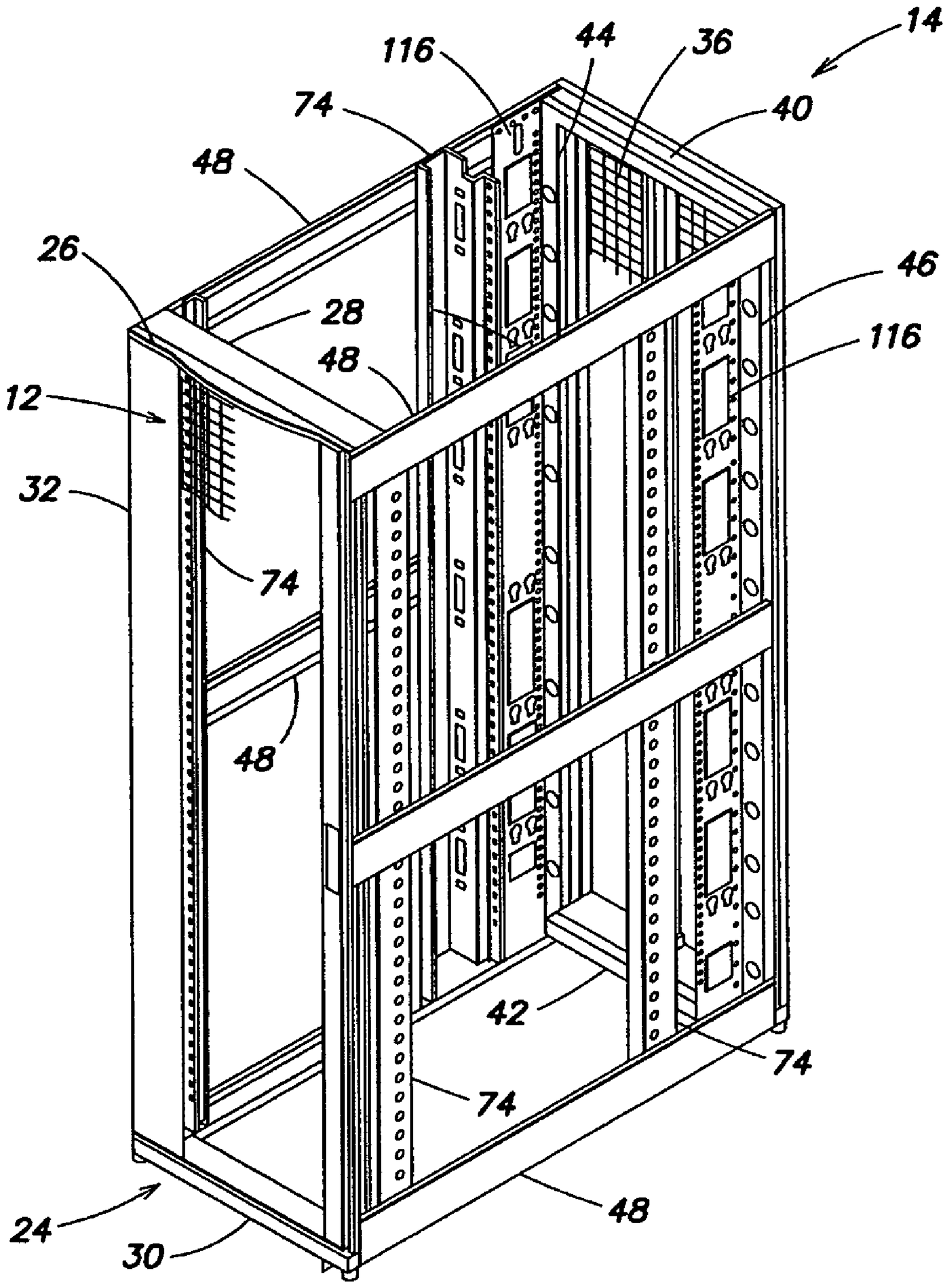

FIG. 12

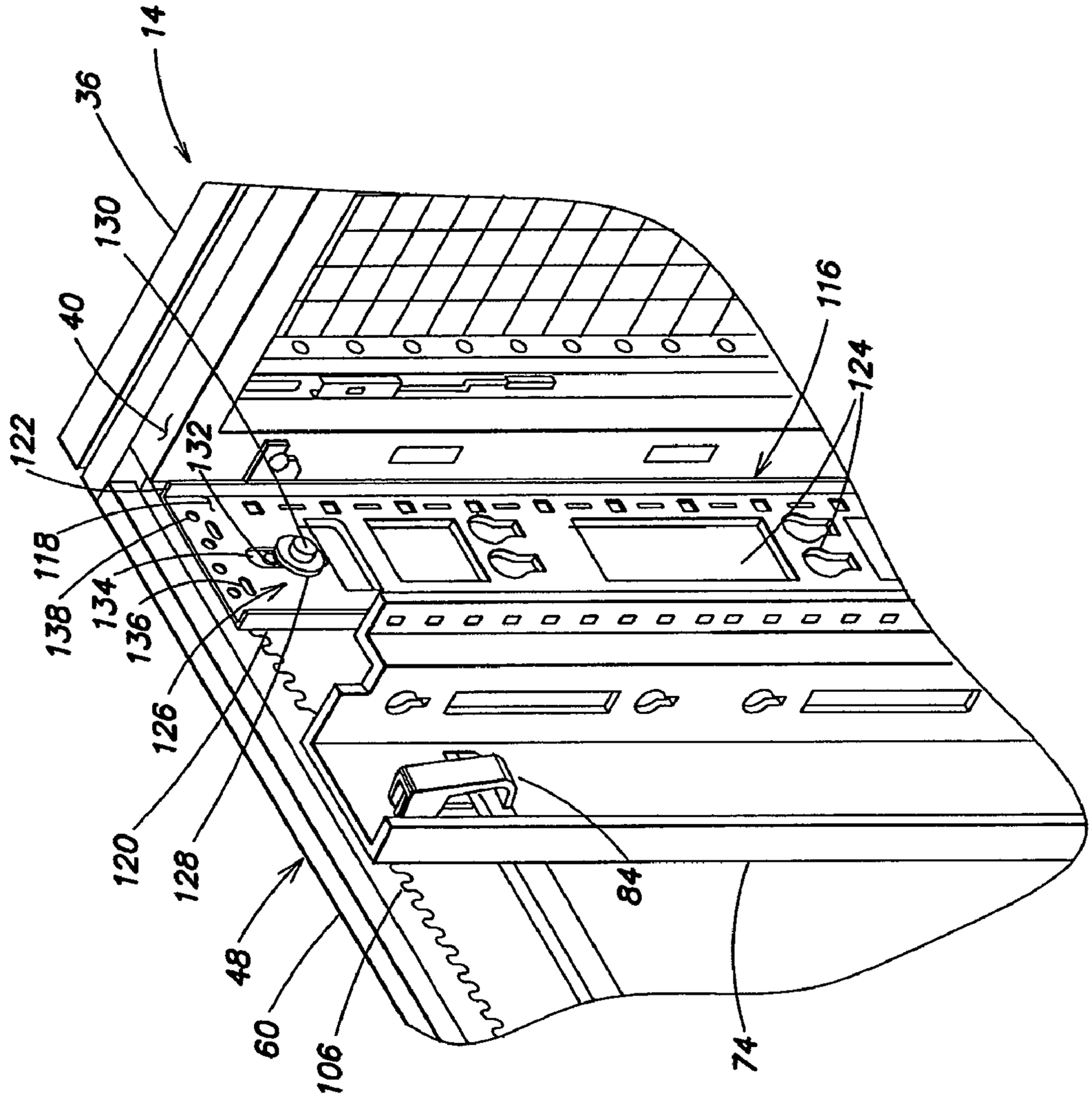
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FIG. 13

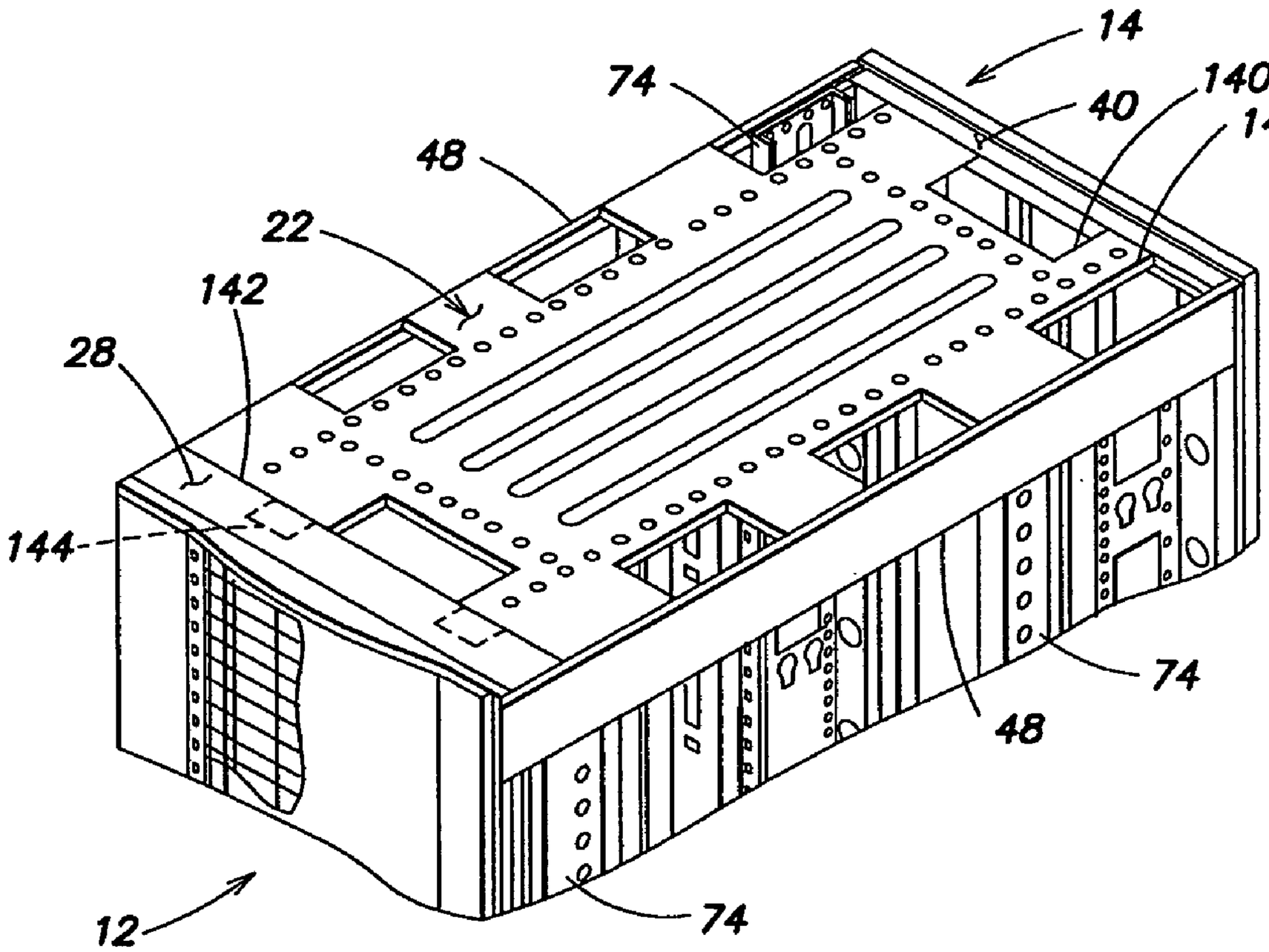


FIG. 14

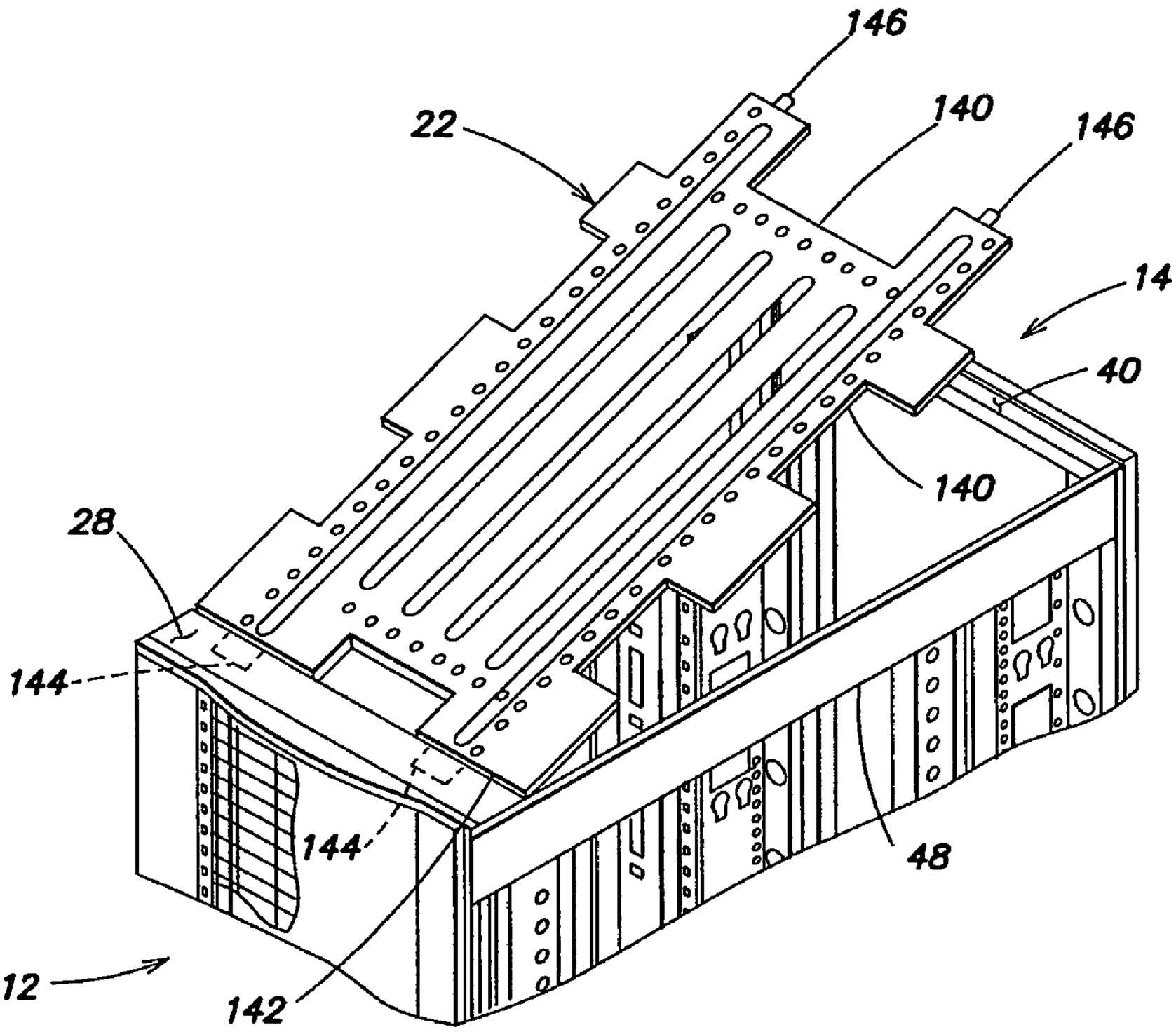


FIG. 15

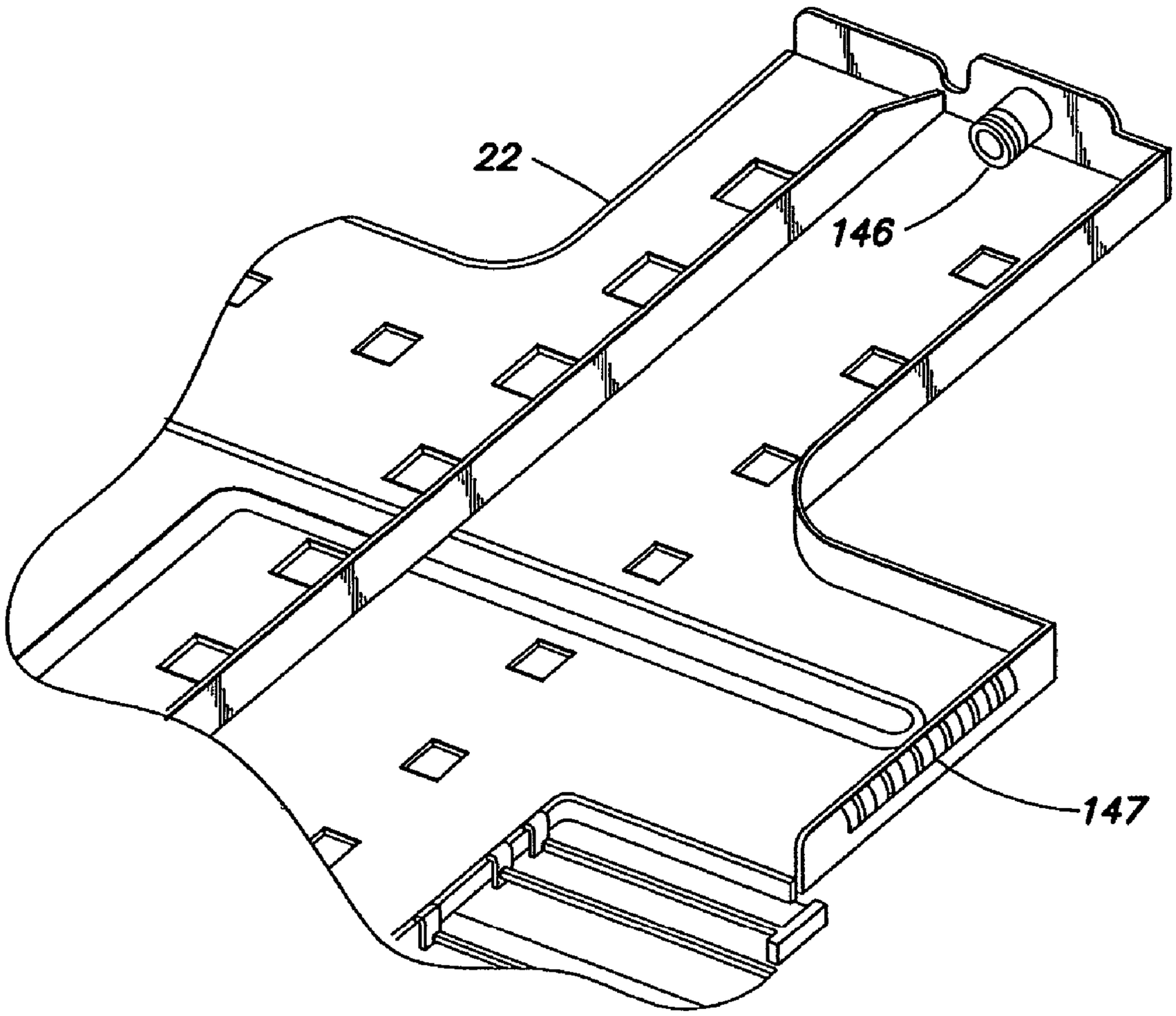


FIG. 15A

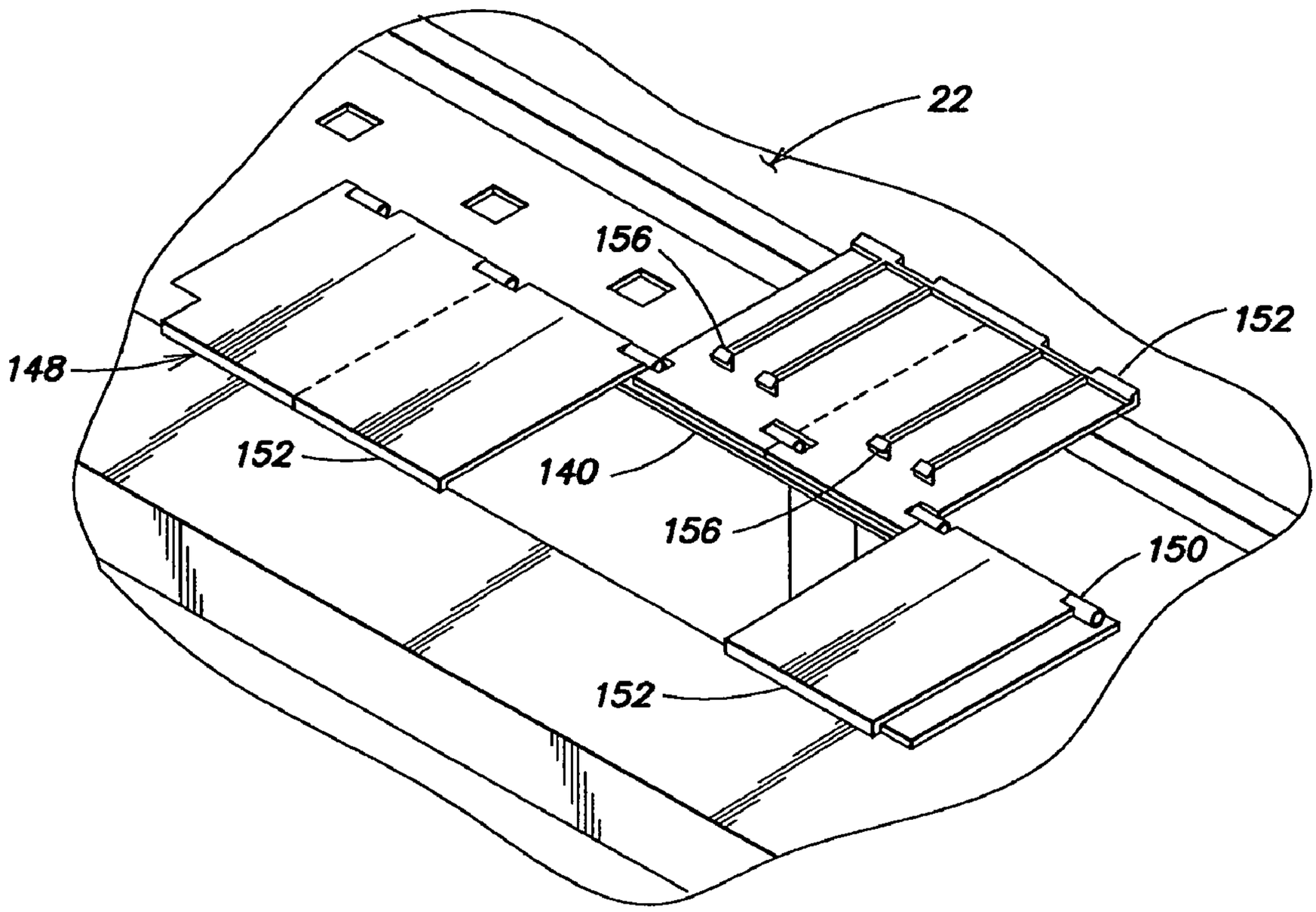


FIG. 16A

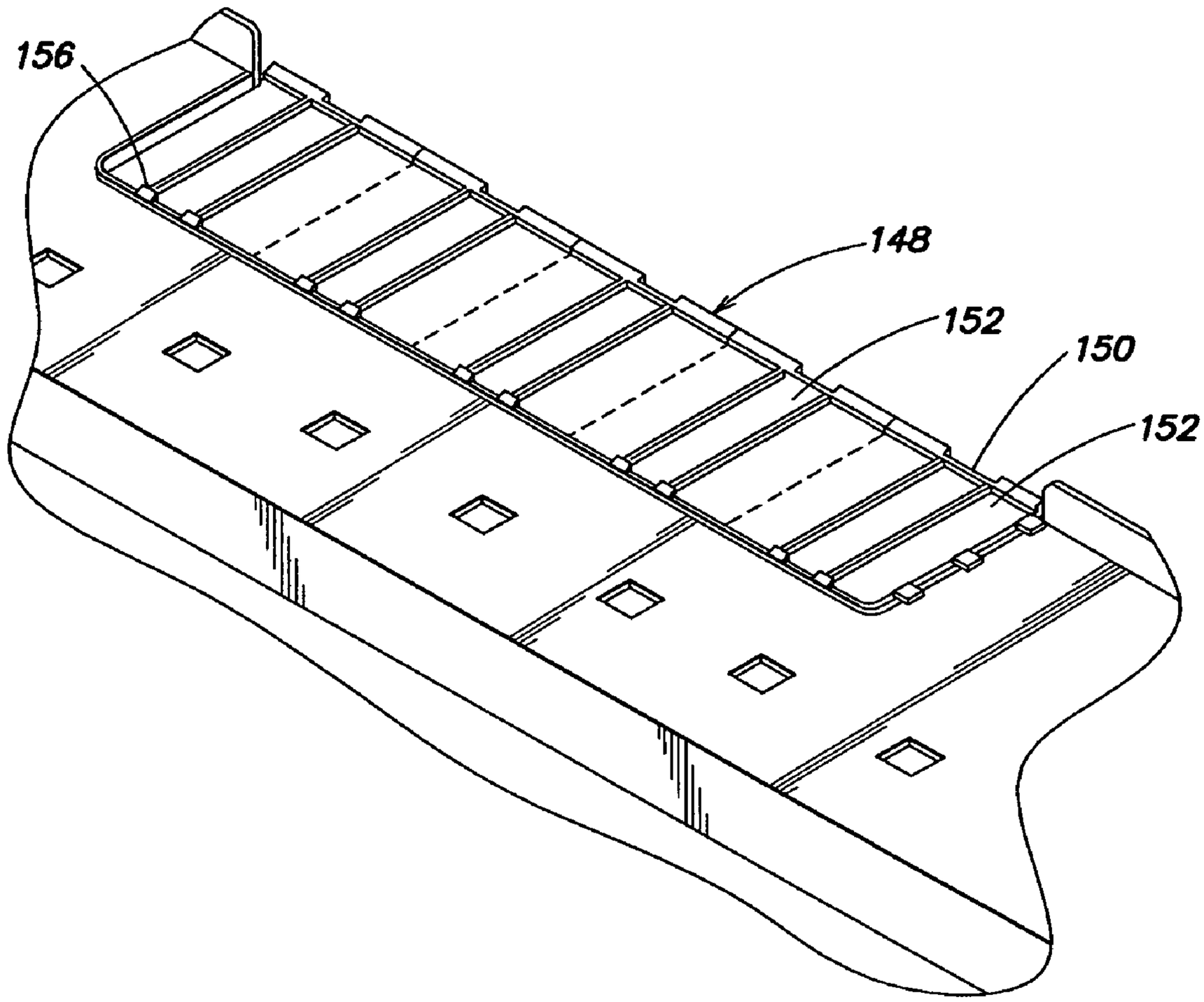


FIG. 16B

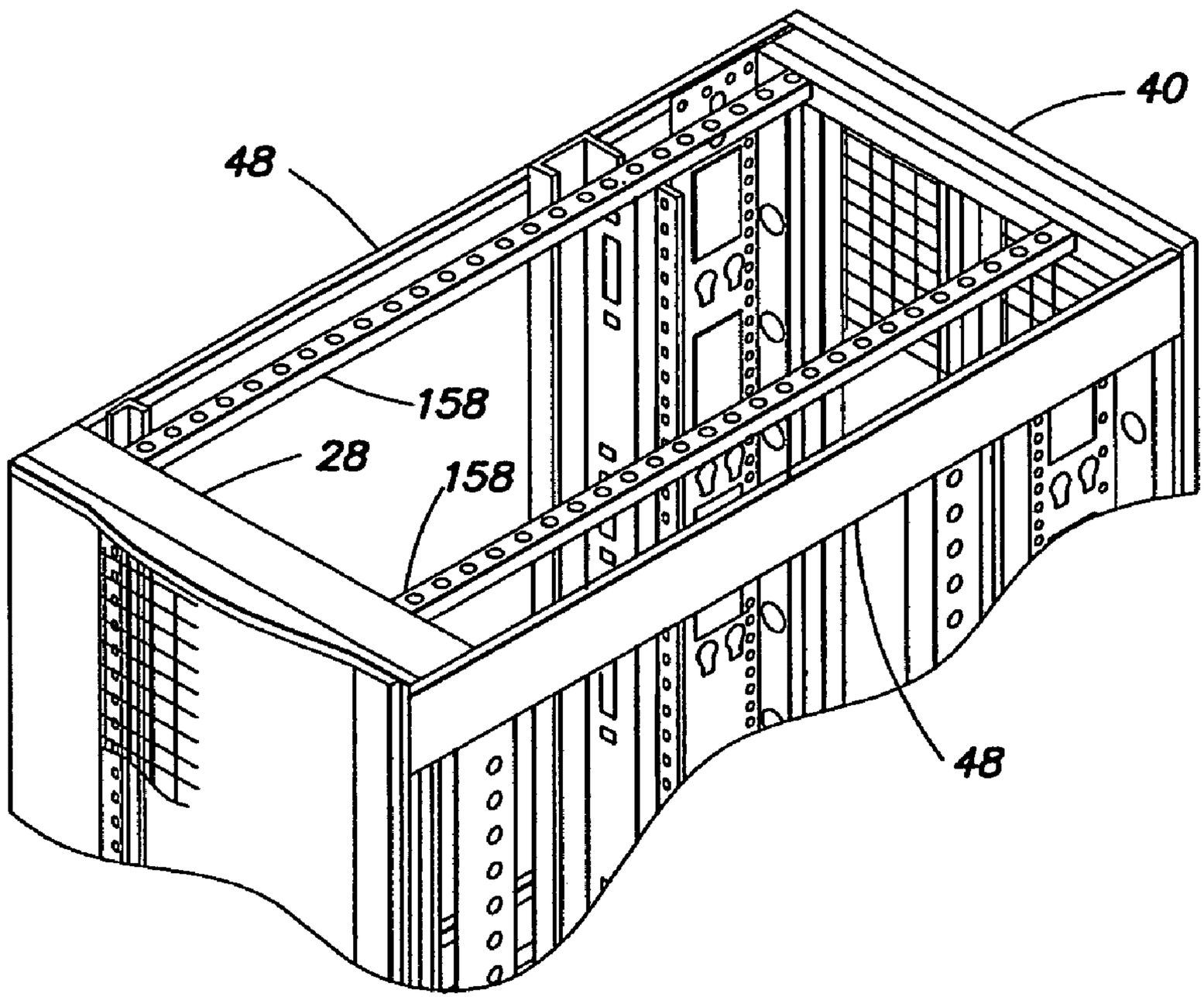


FIG. 17

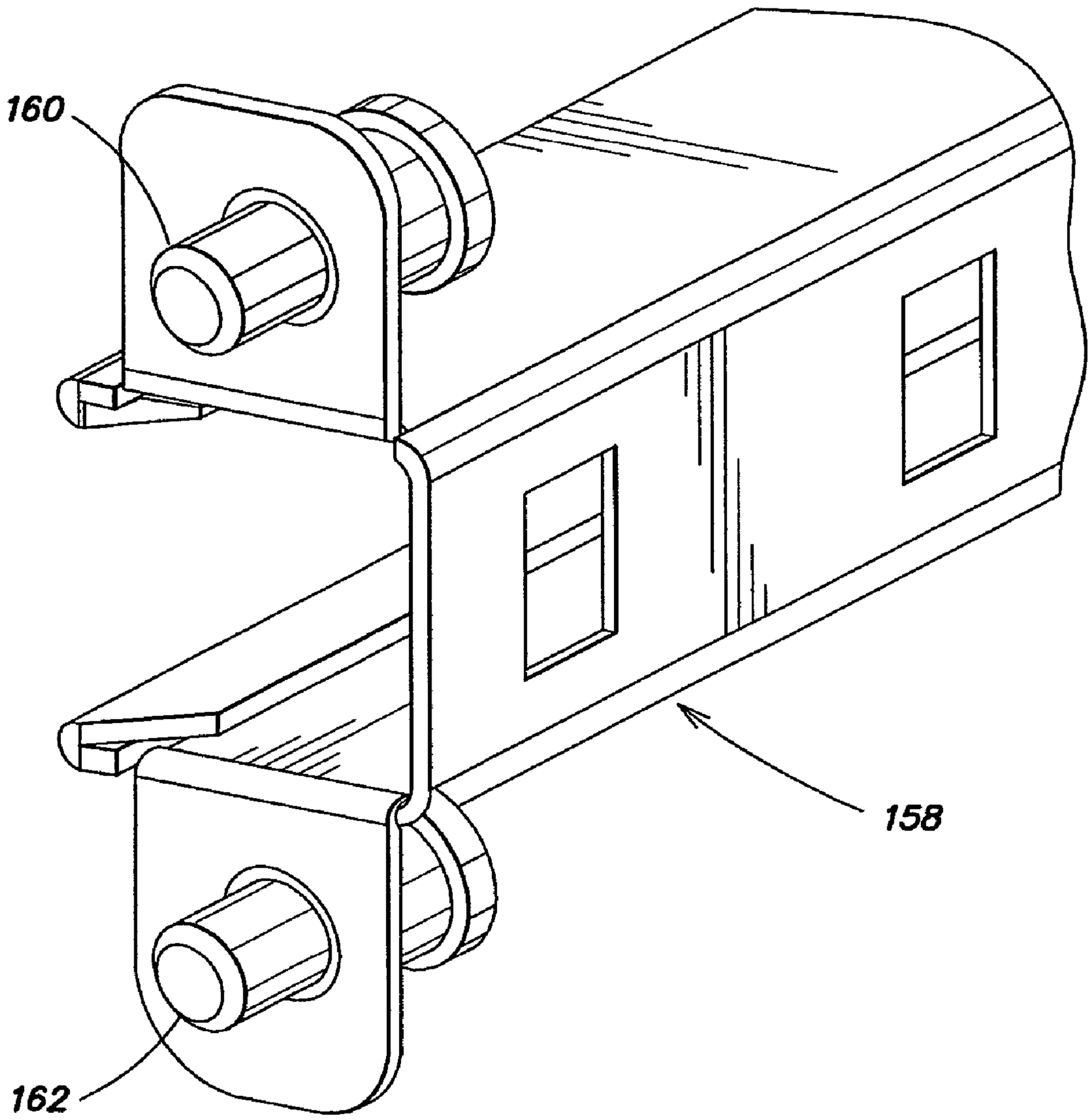


FIG. 18

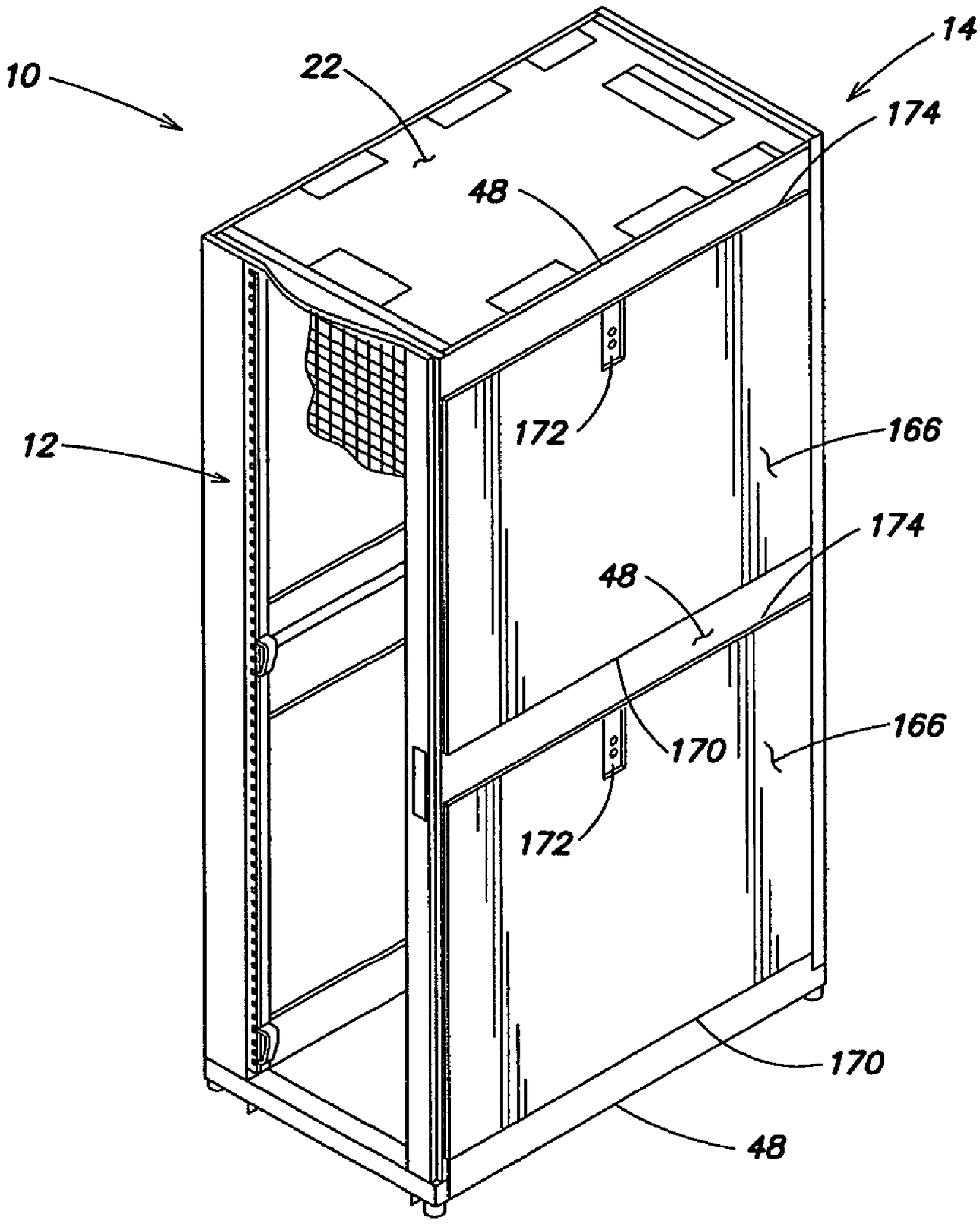


FIG. 19

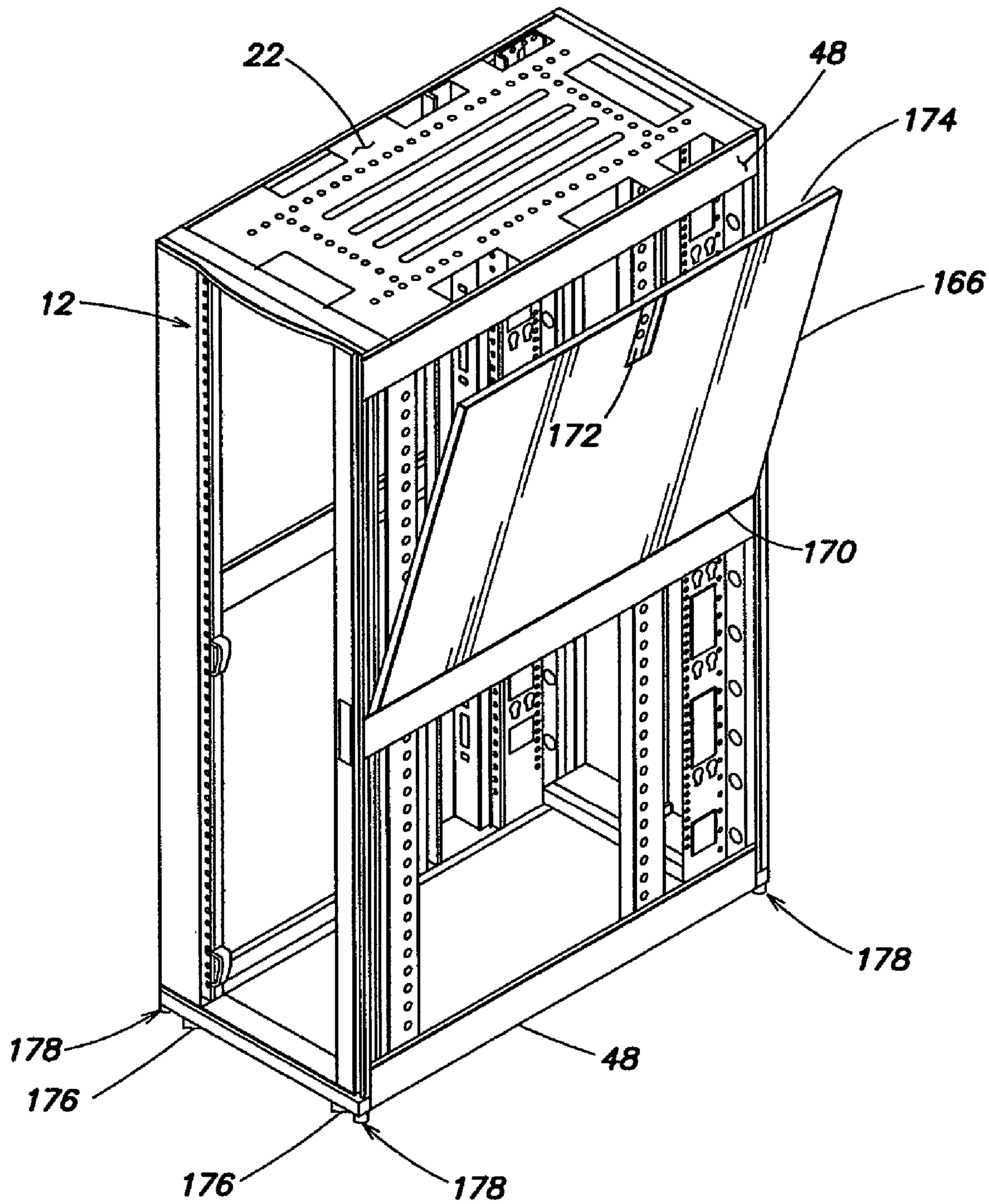


FIG. 20

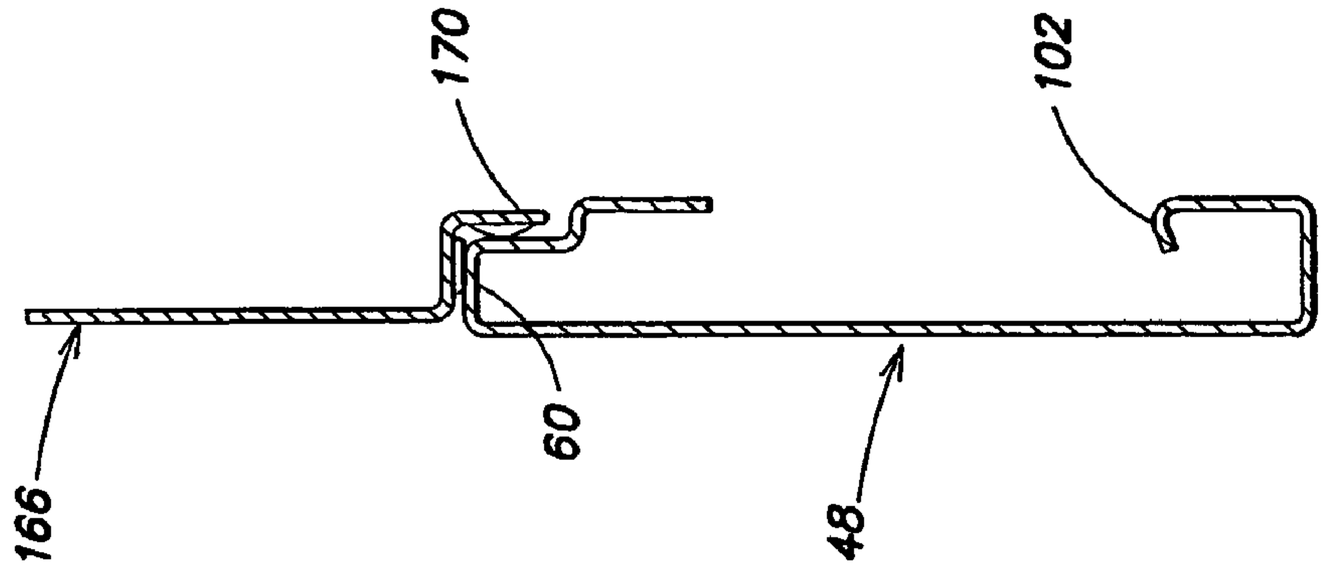


FIG. 20B

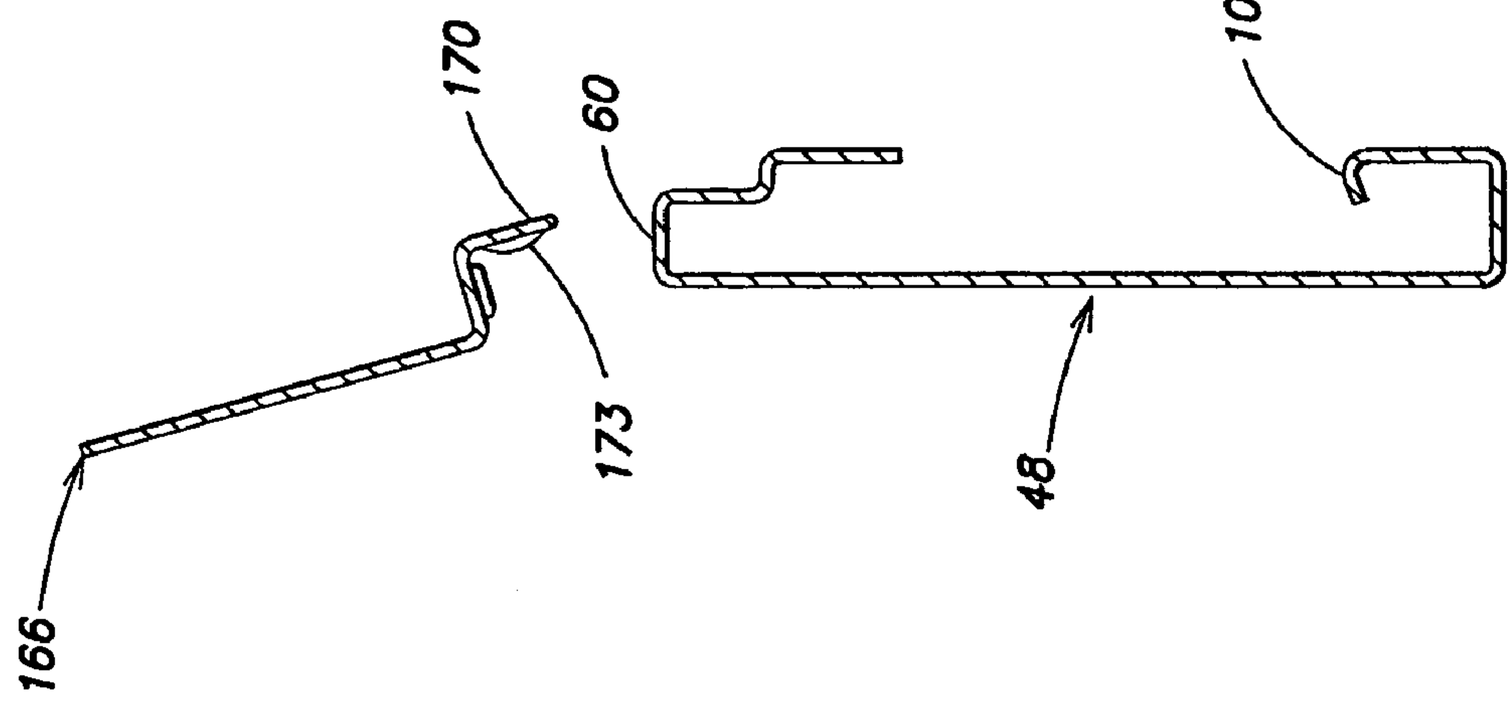


FIG. 20A

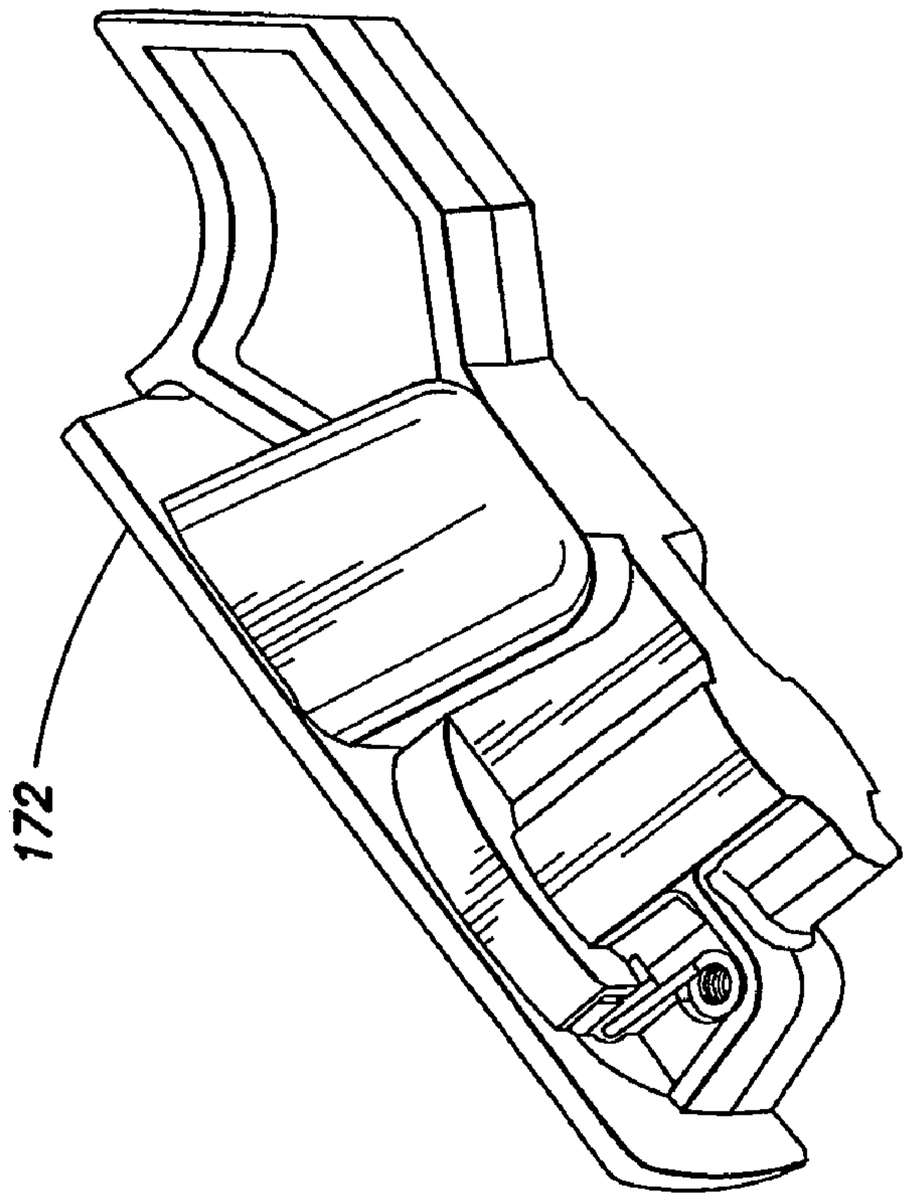


FIG. 20D

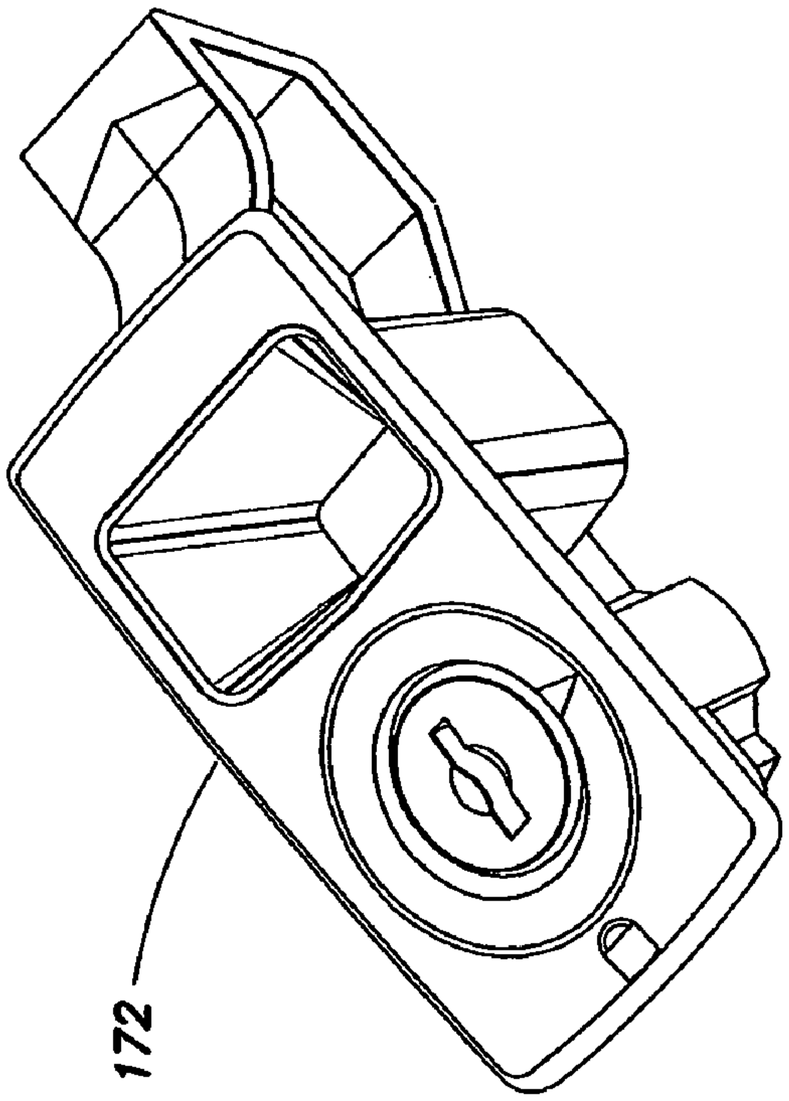
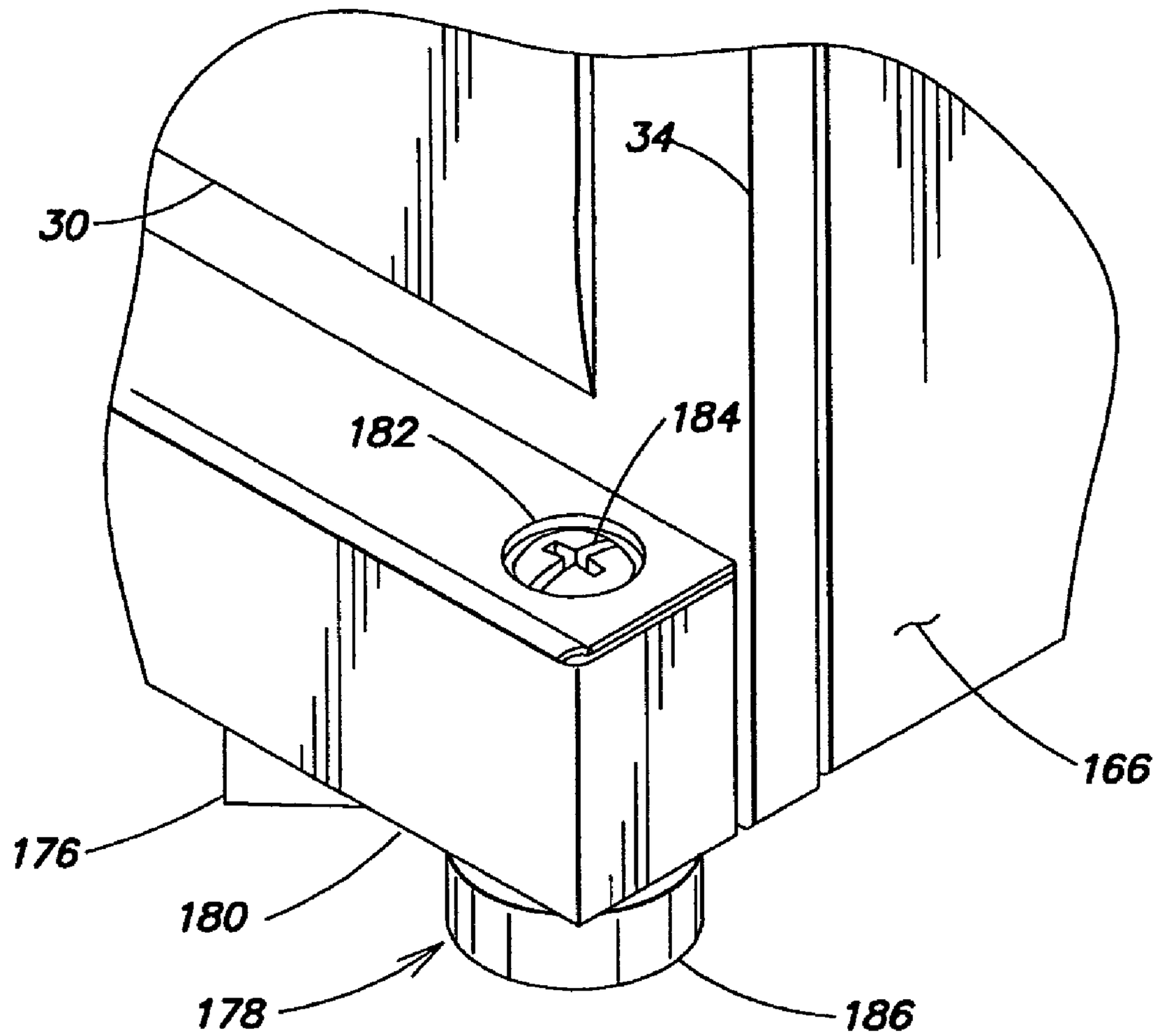


FIG. 20C



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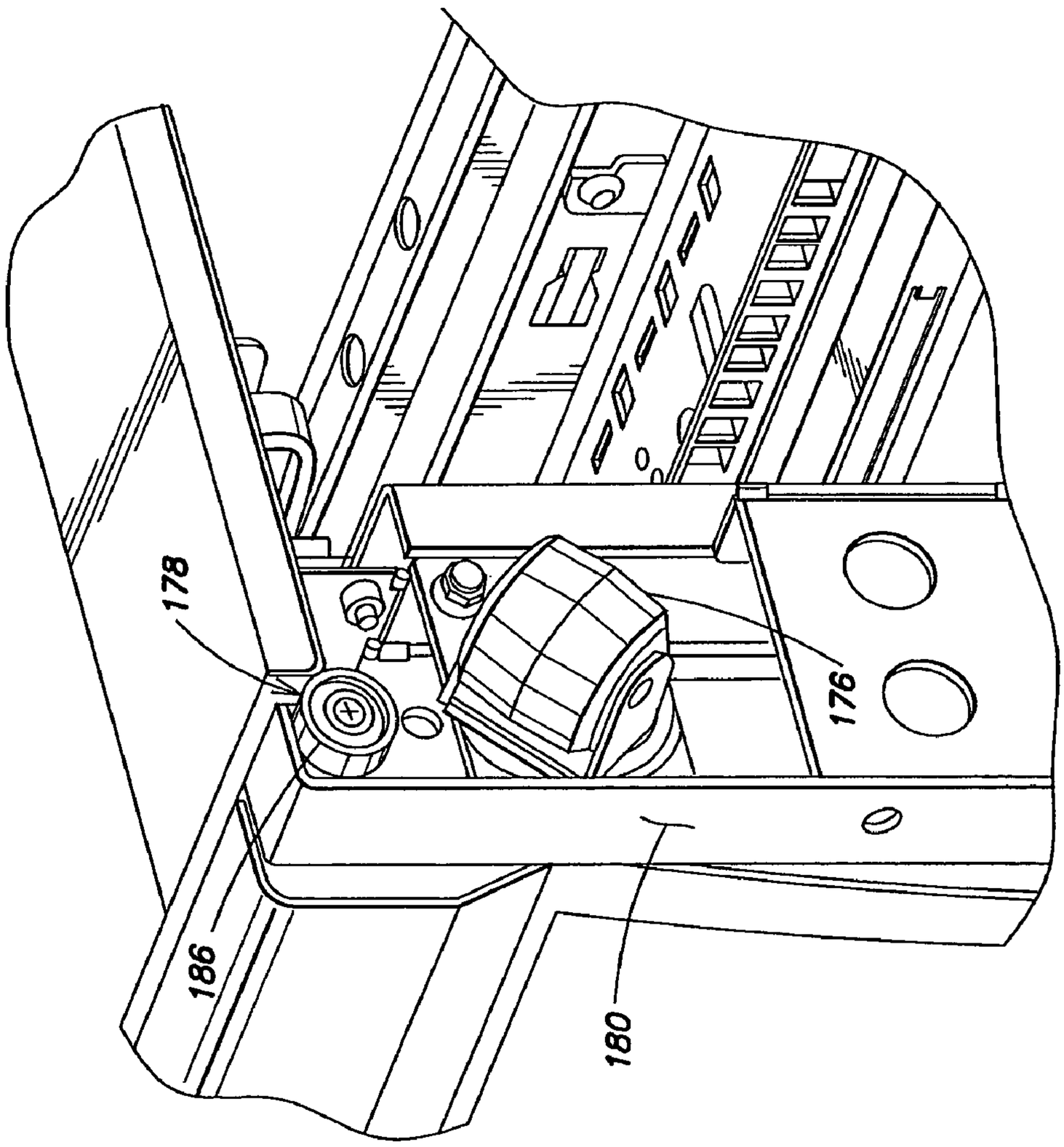
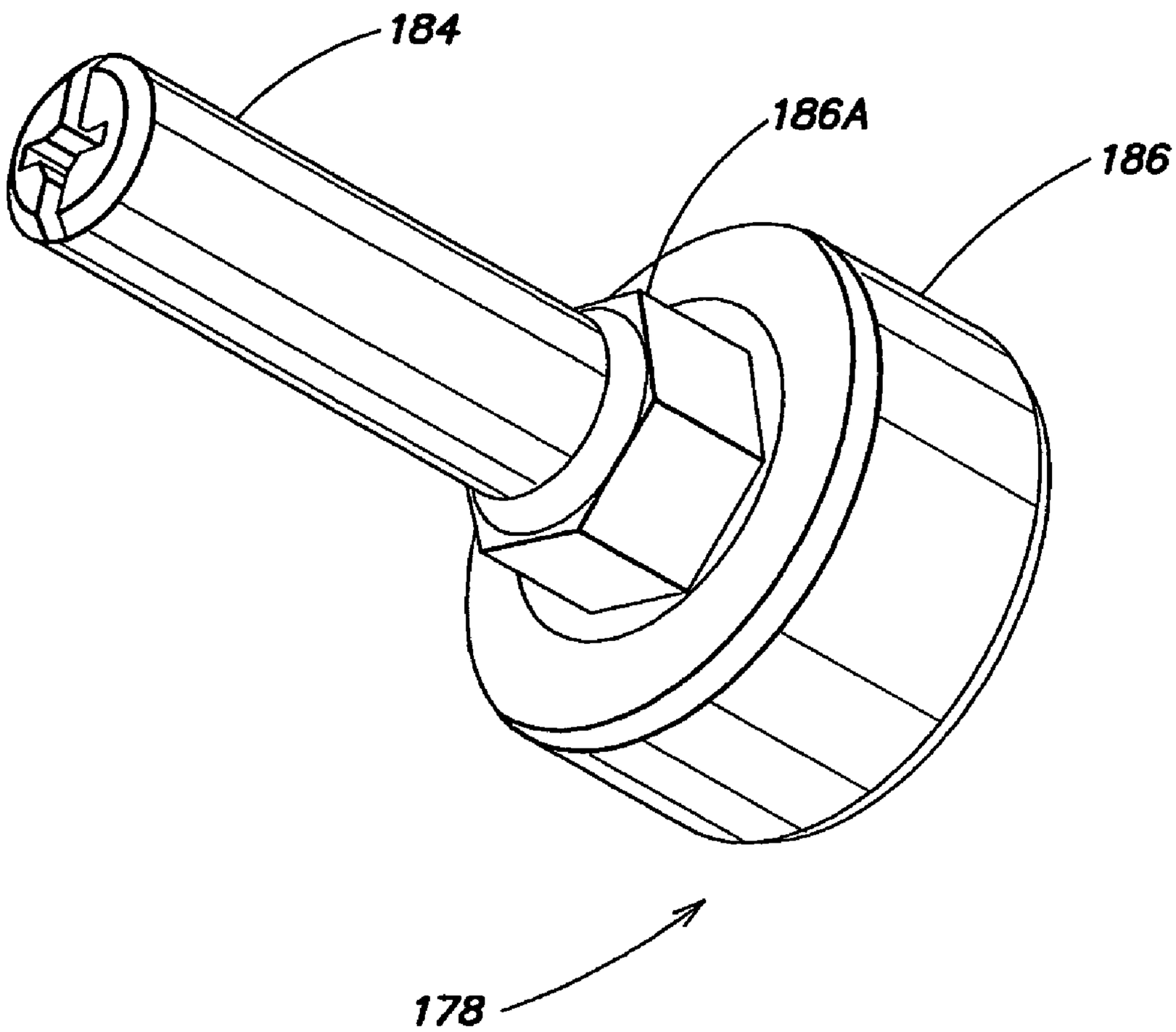


FIG. 21A



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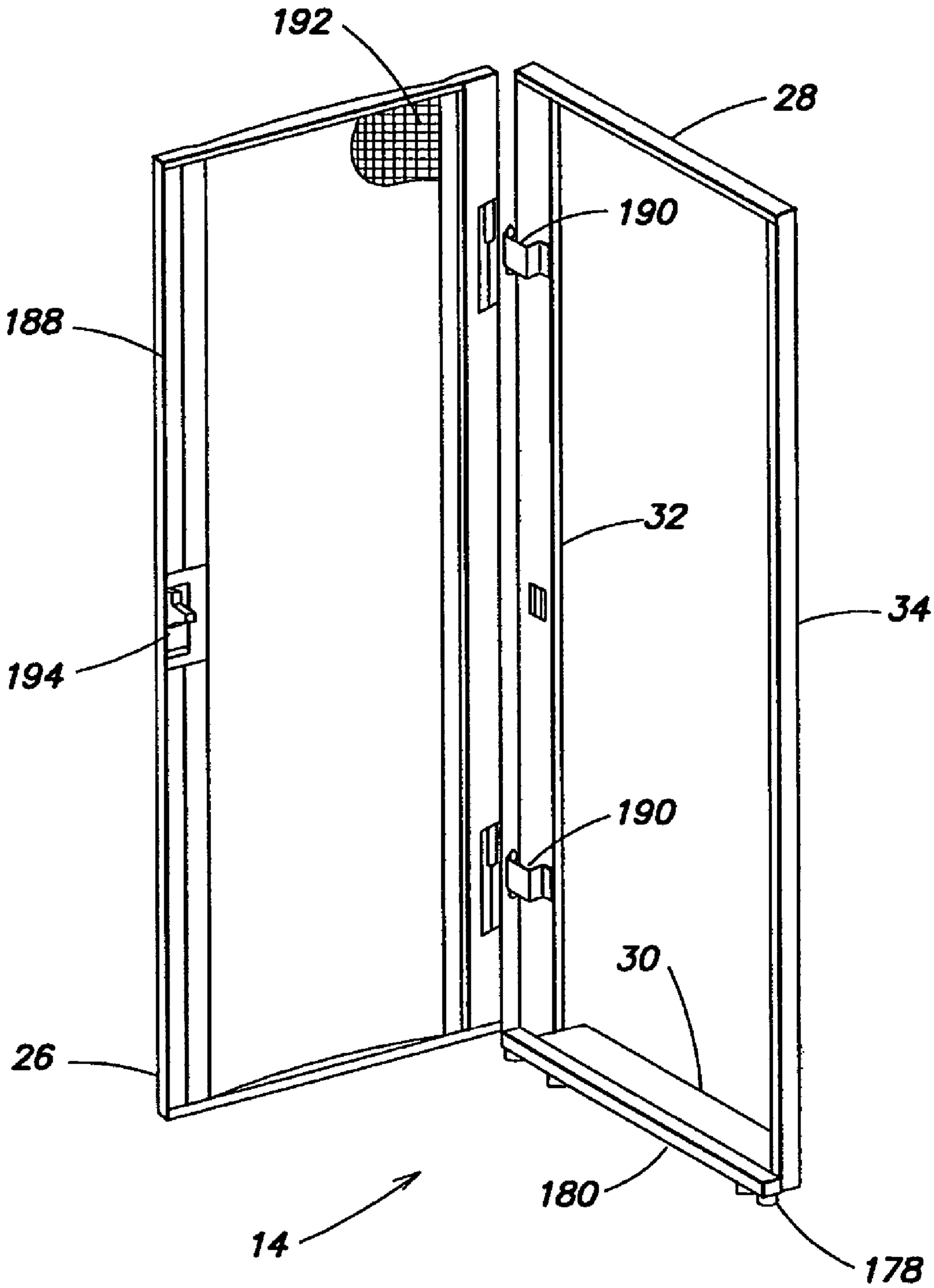


FIG. 22

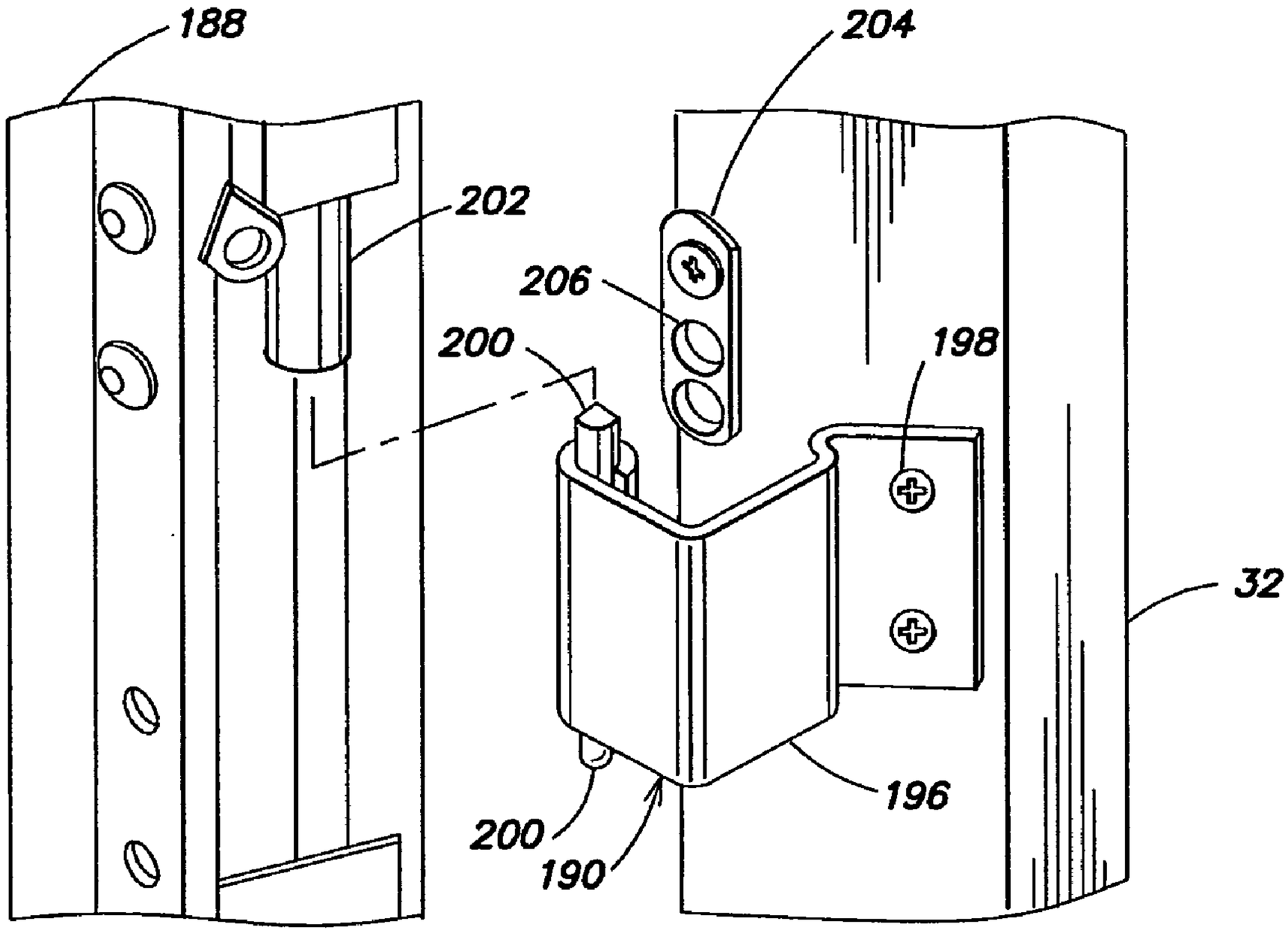
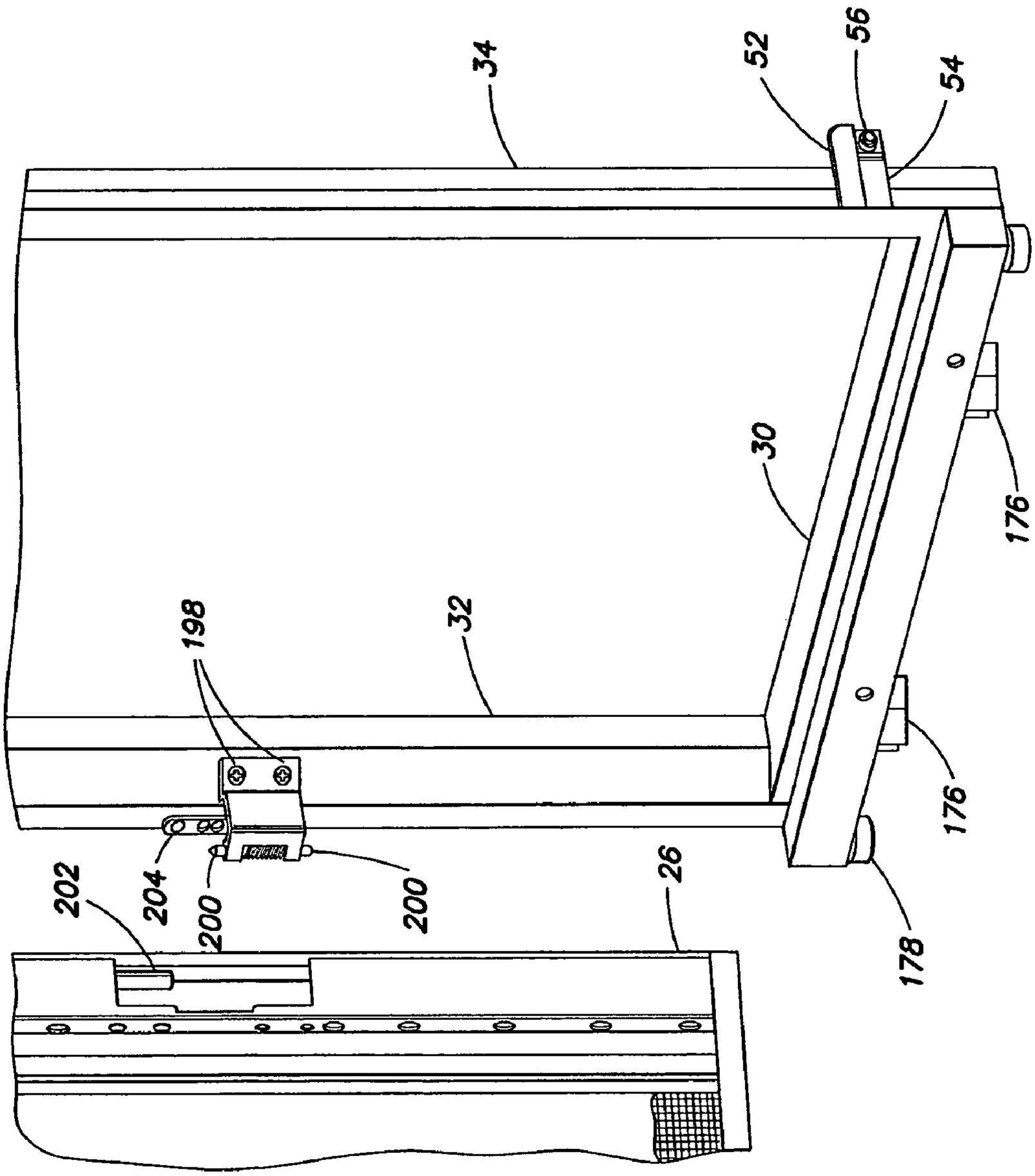


FIG. 23



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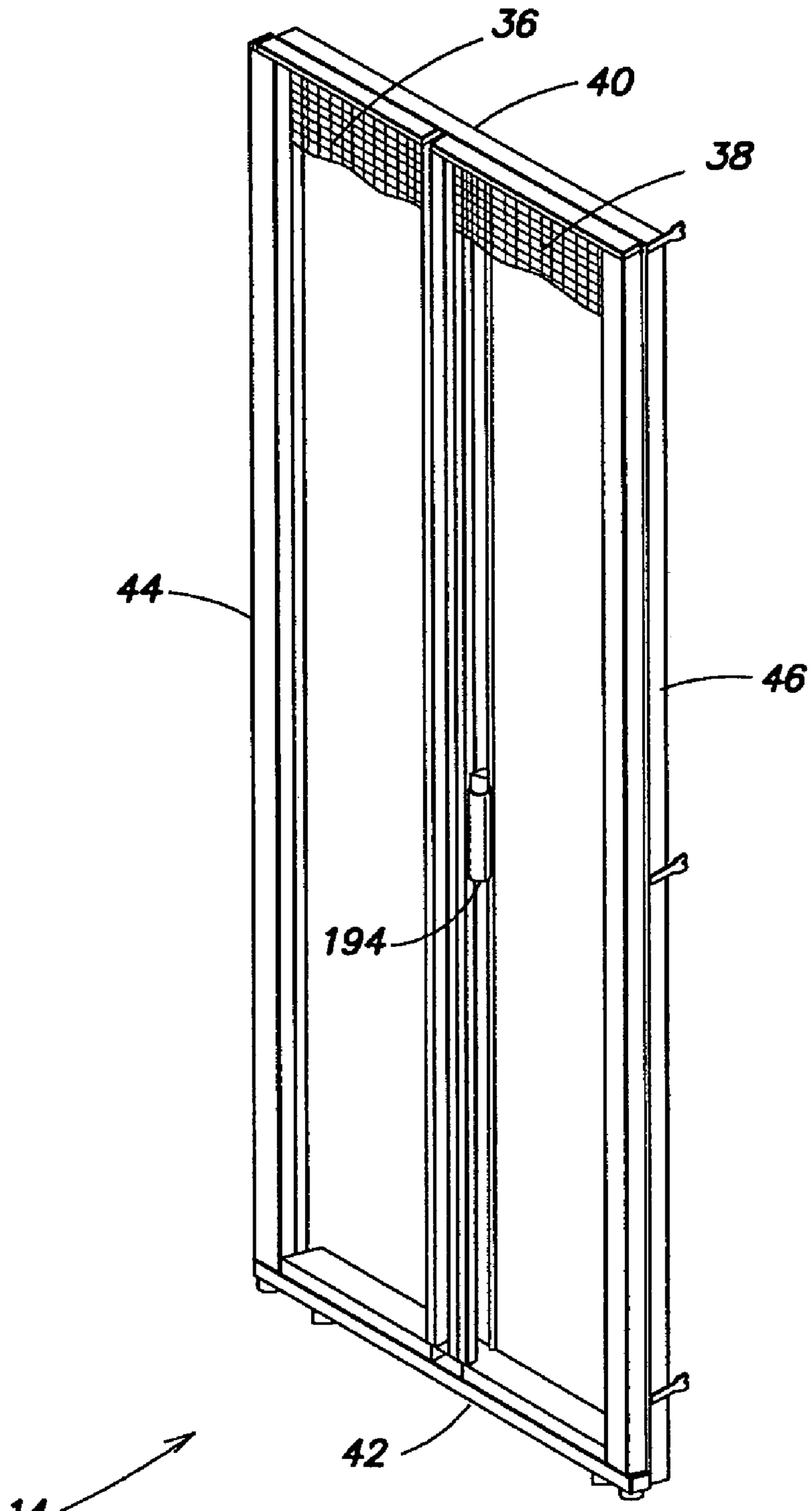

FIG. 24

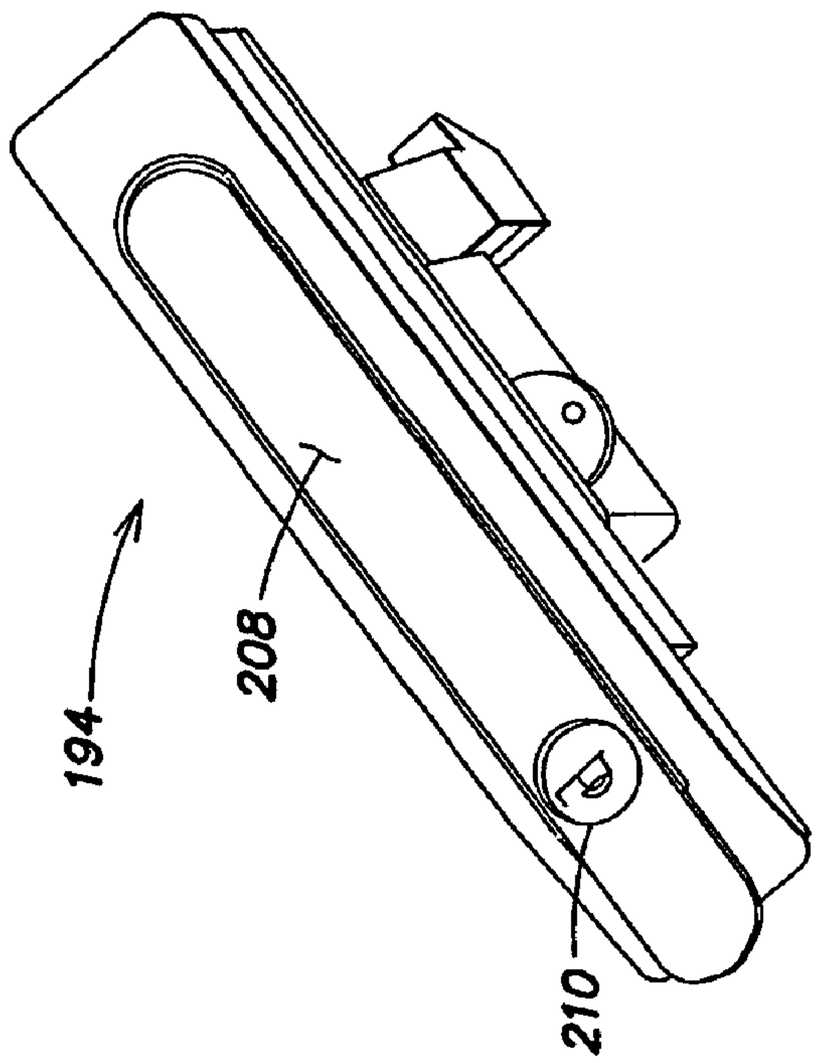

FIG. 26

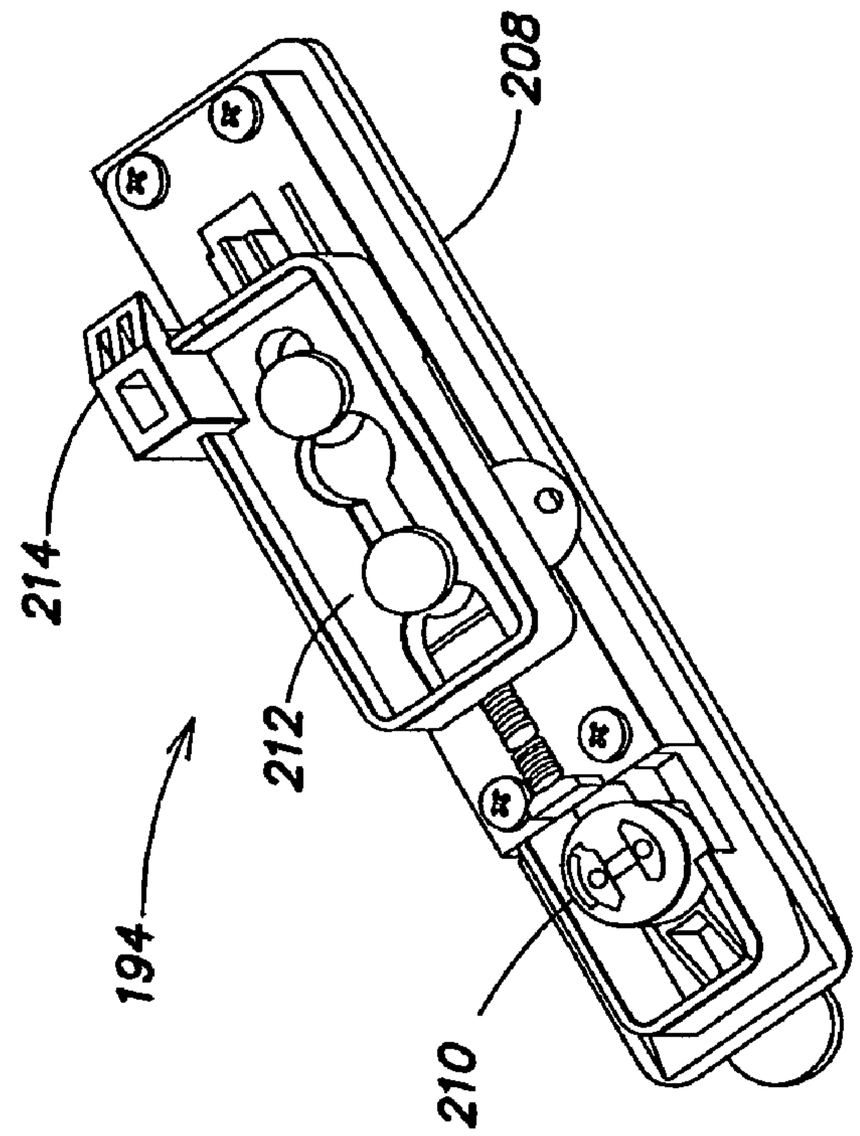

FIG. 25

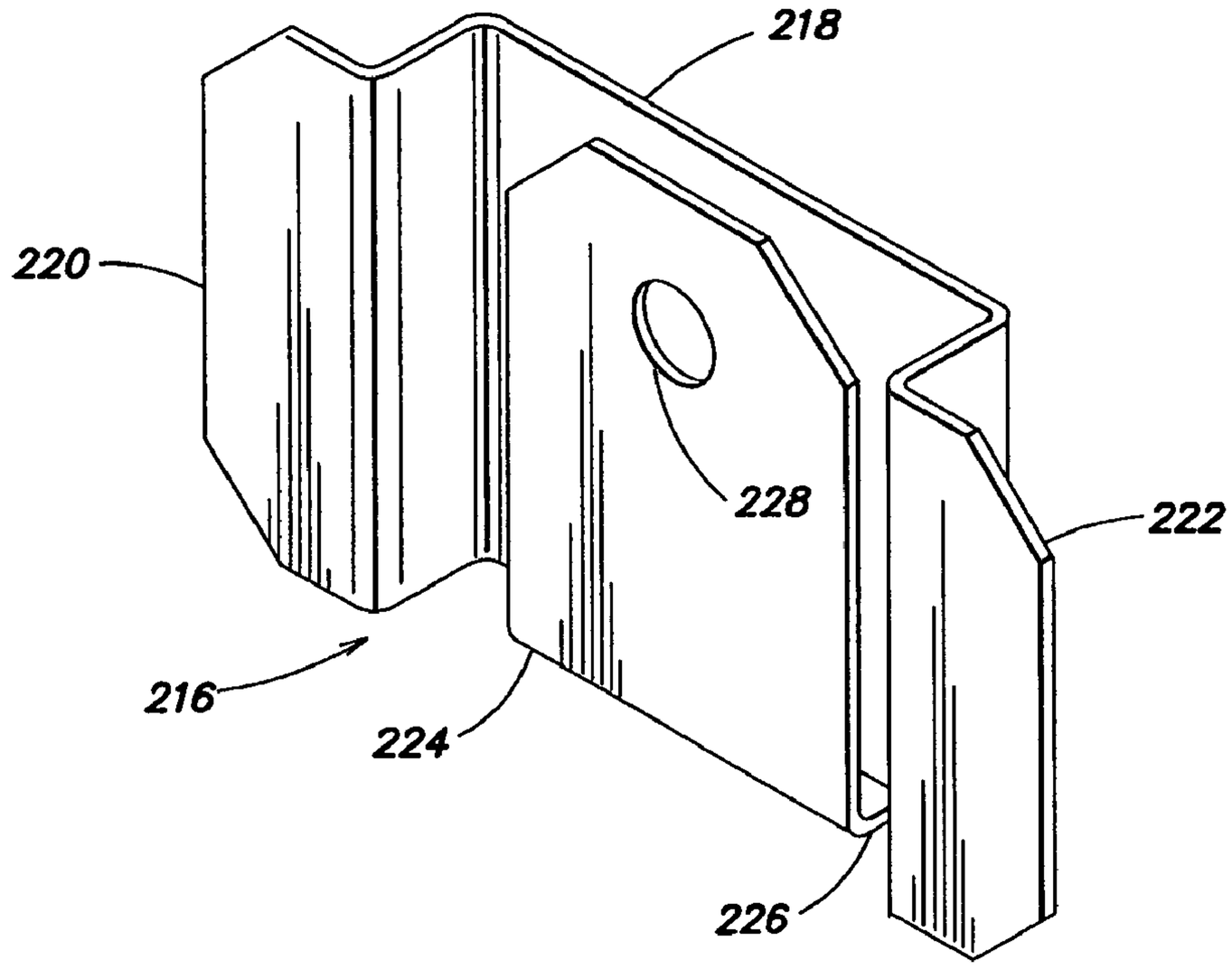

FIG. 27

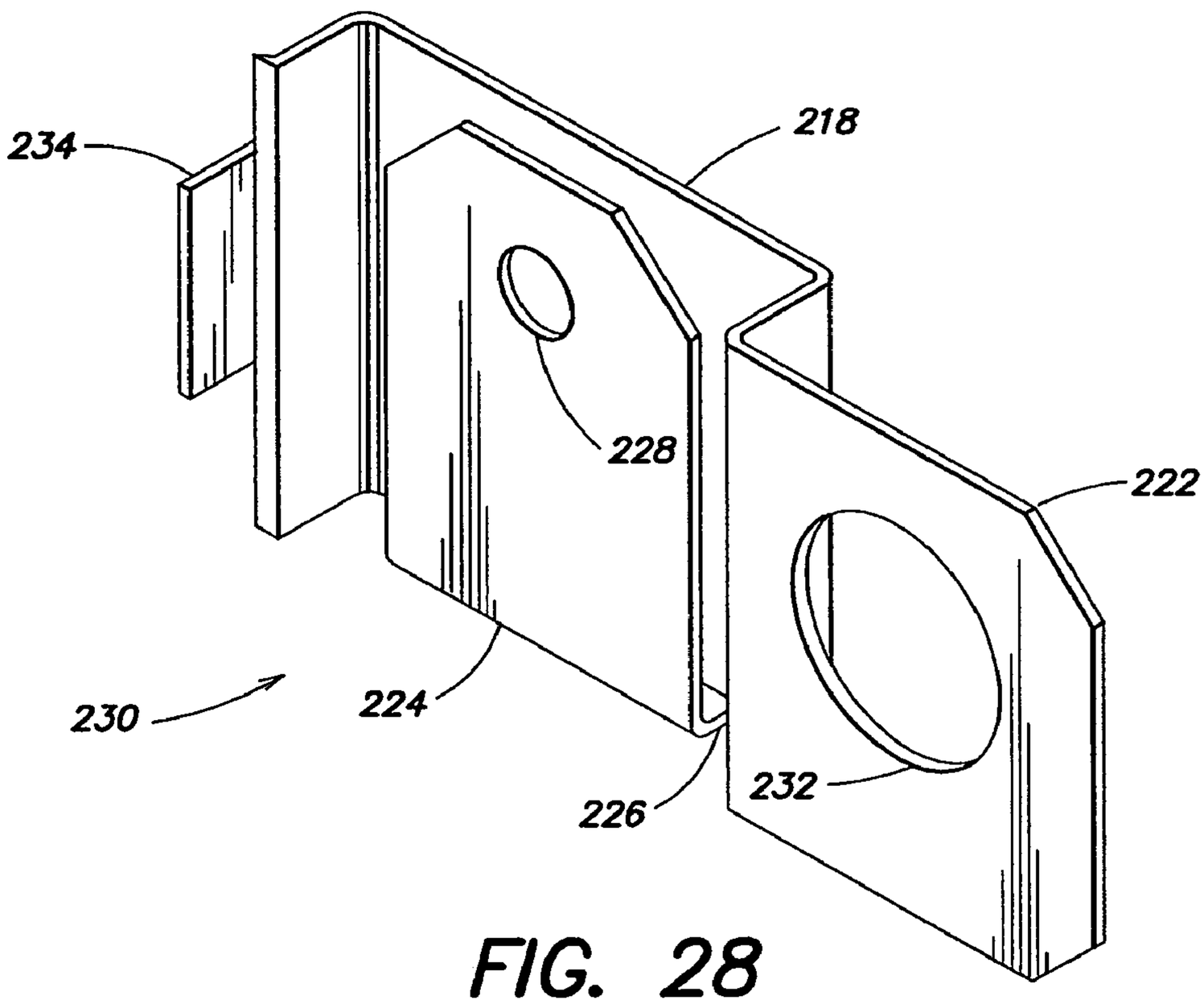

FIG. 28

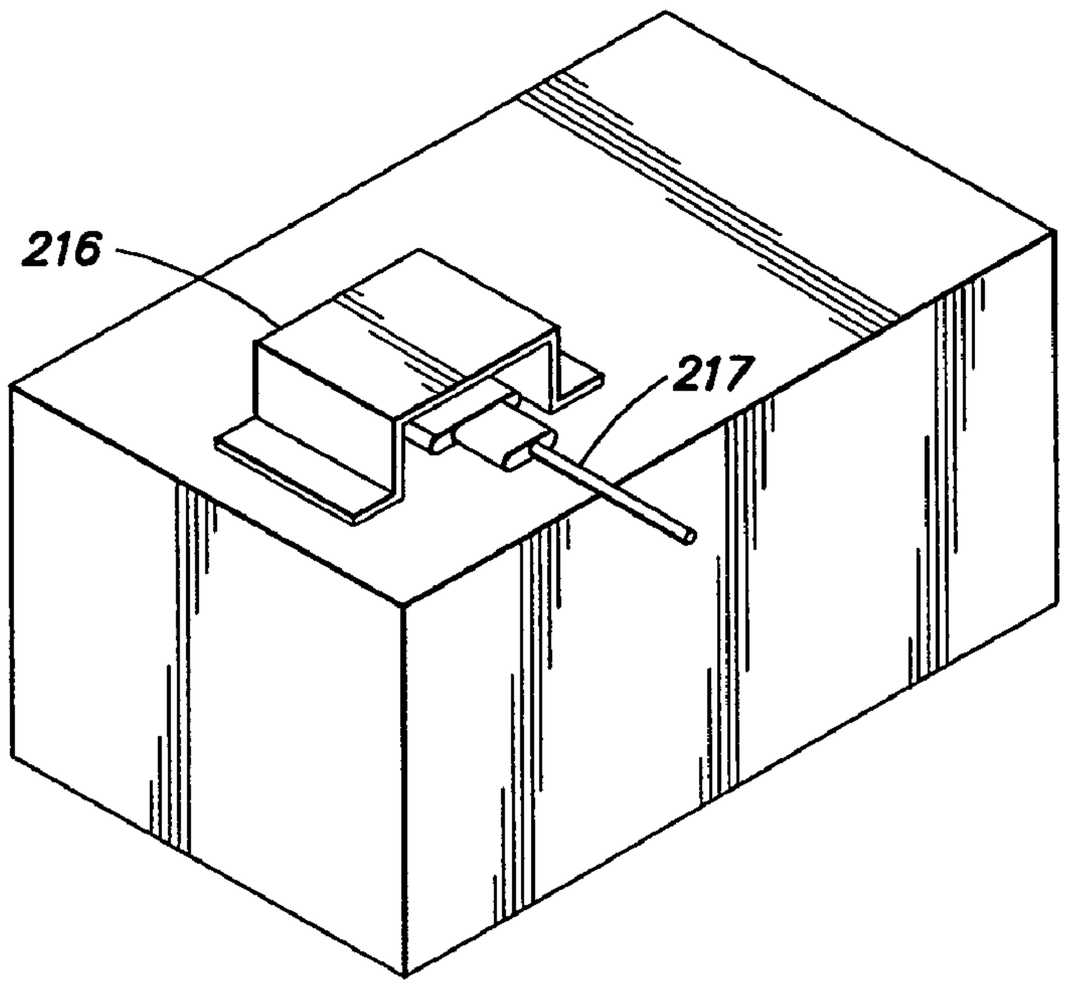

FIG. 27A

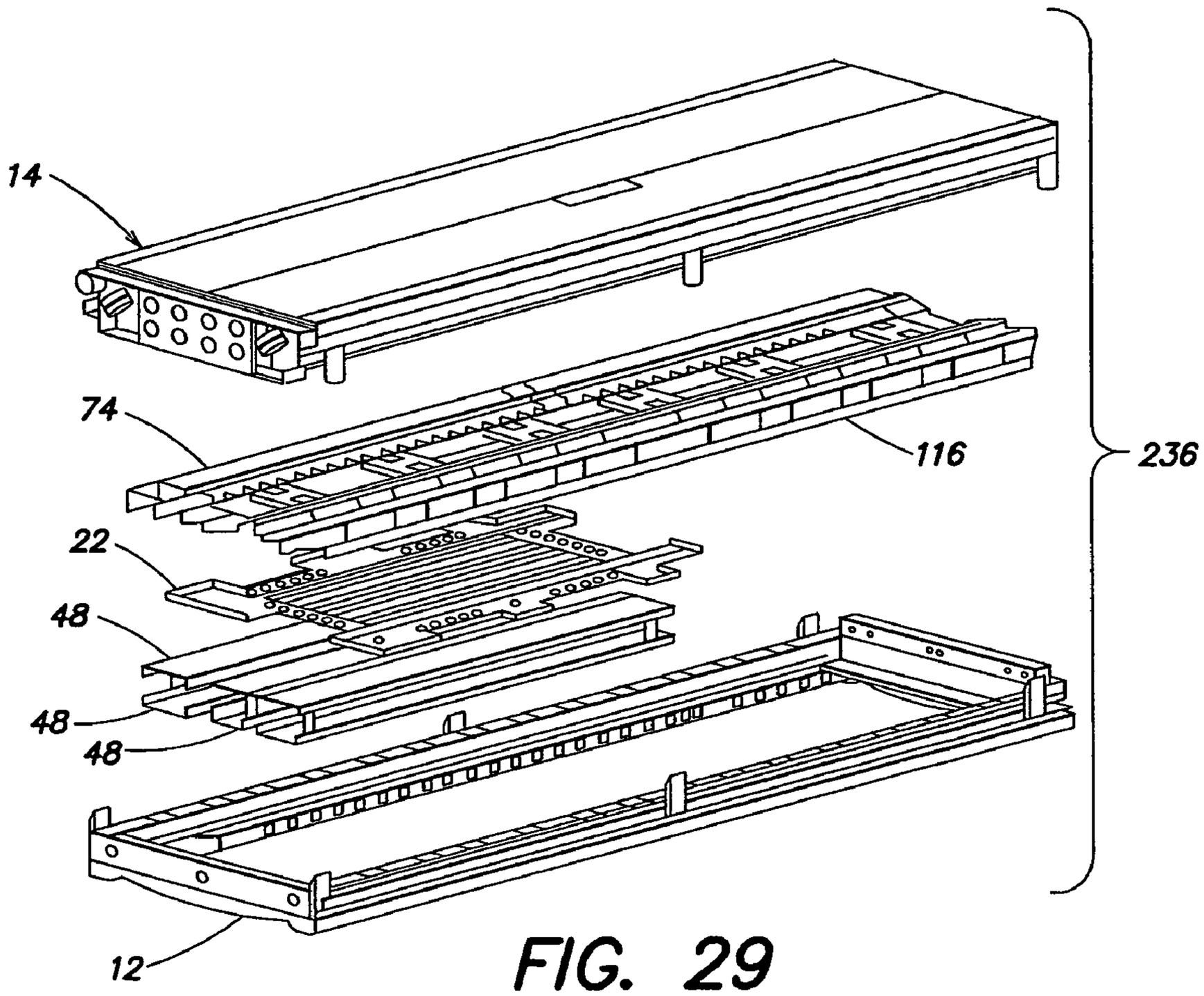

FIG. 29

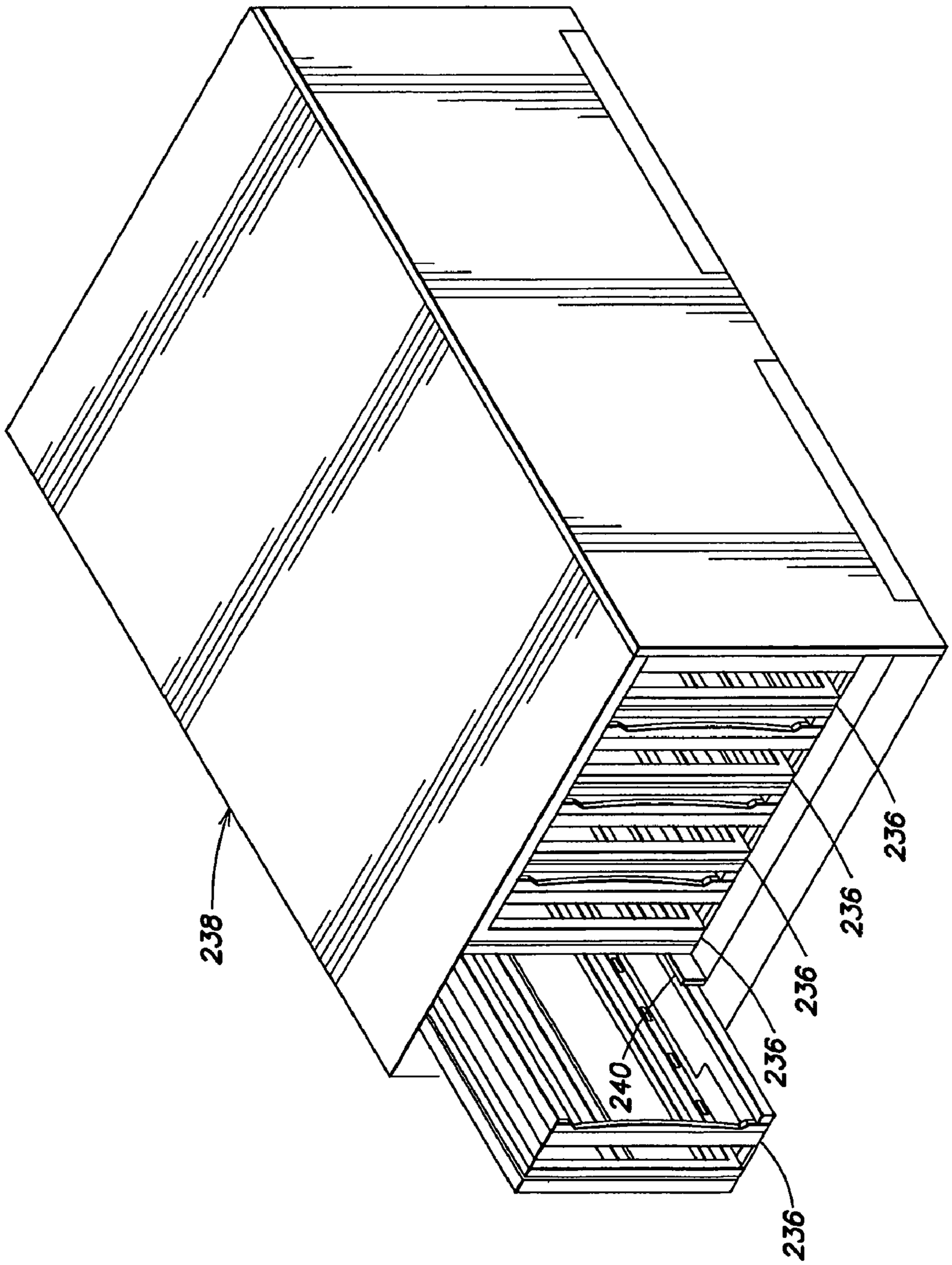

FIG. 30

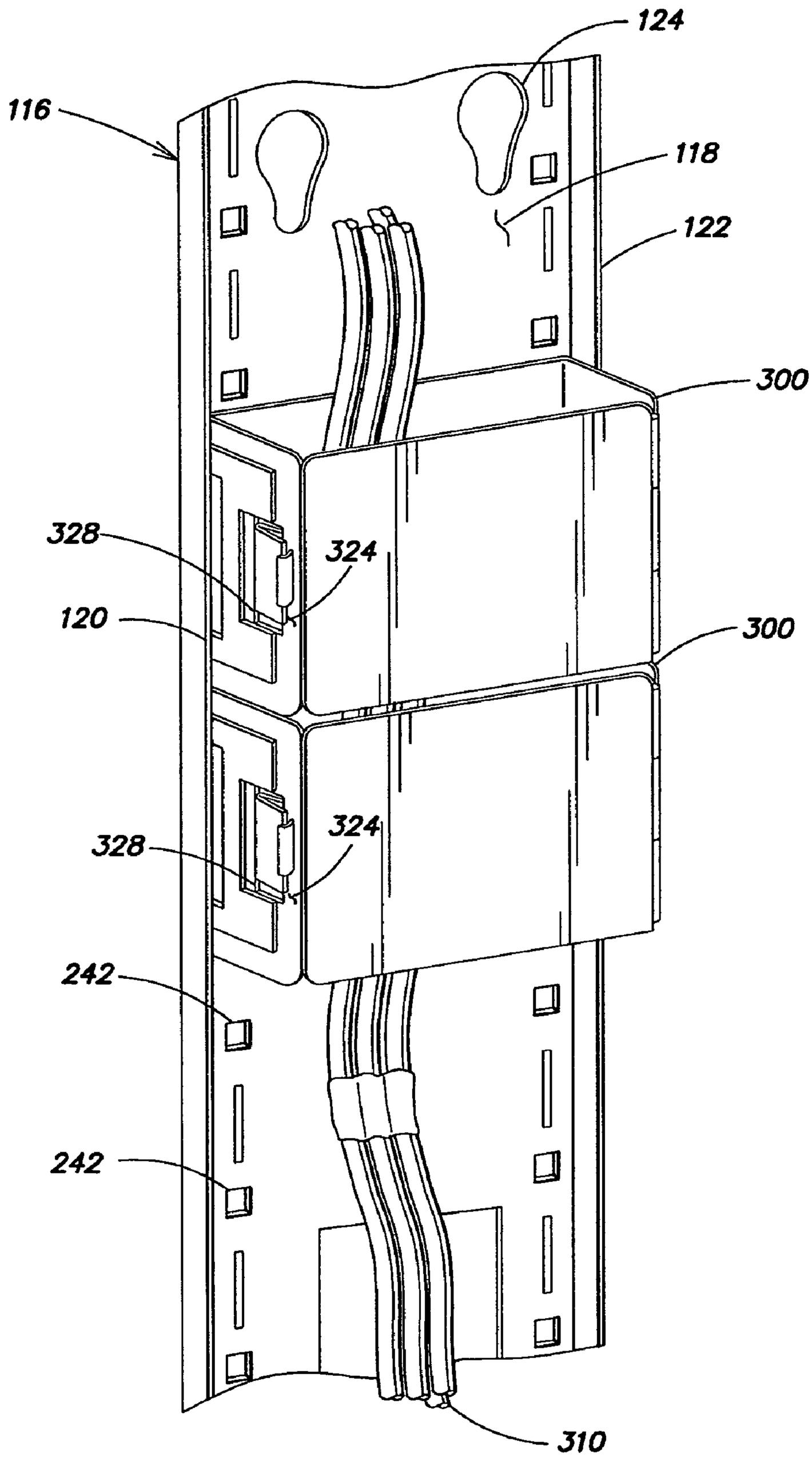

FIG. 31

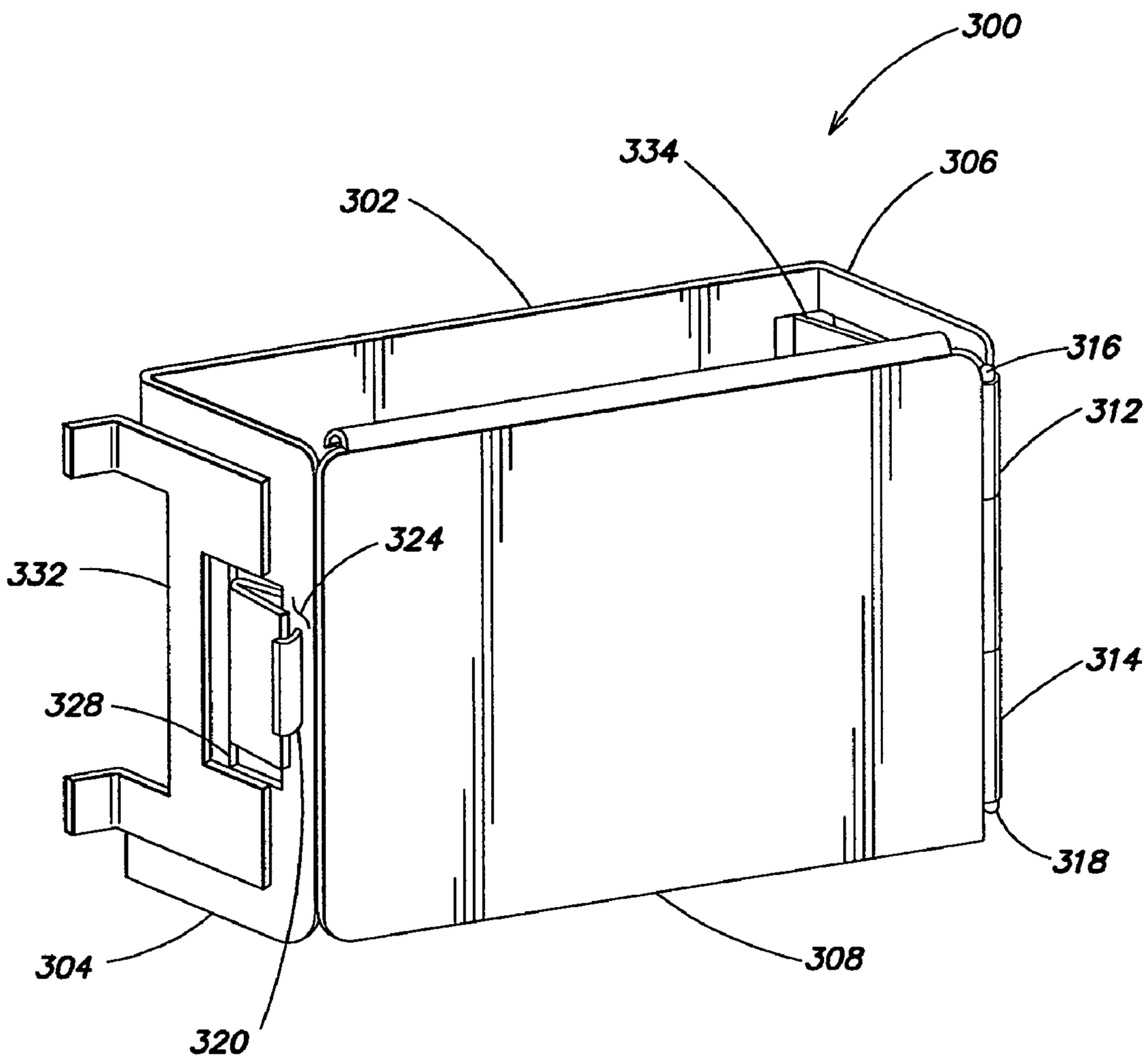

FIG. 32

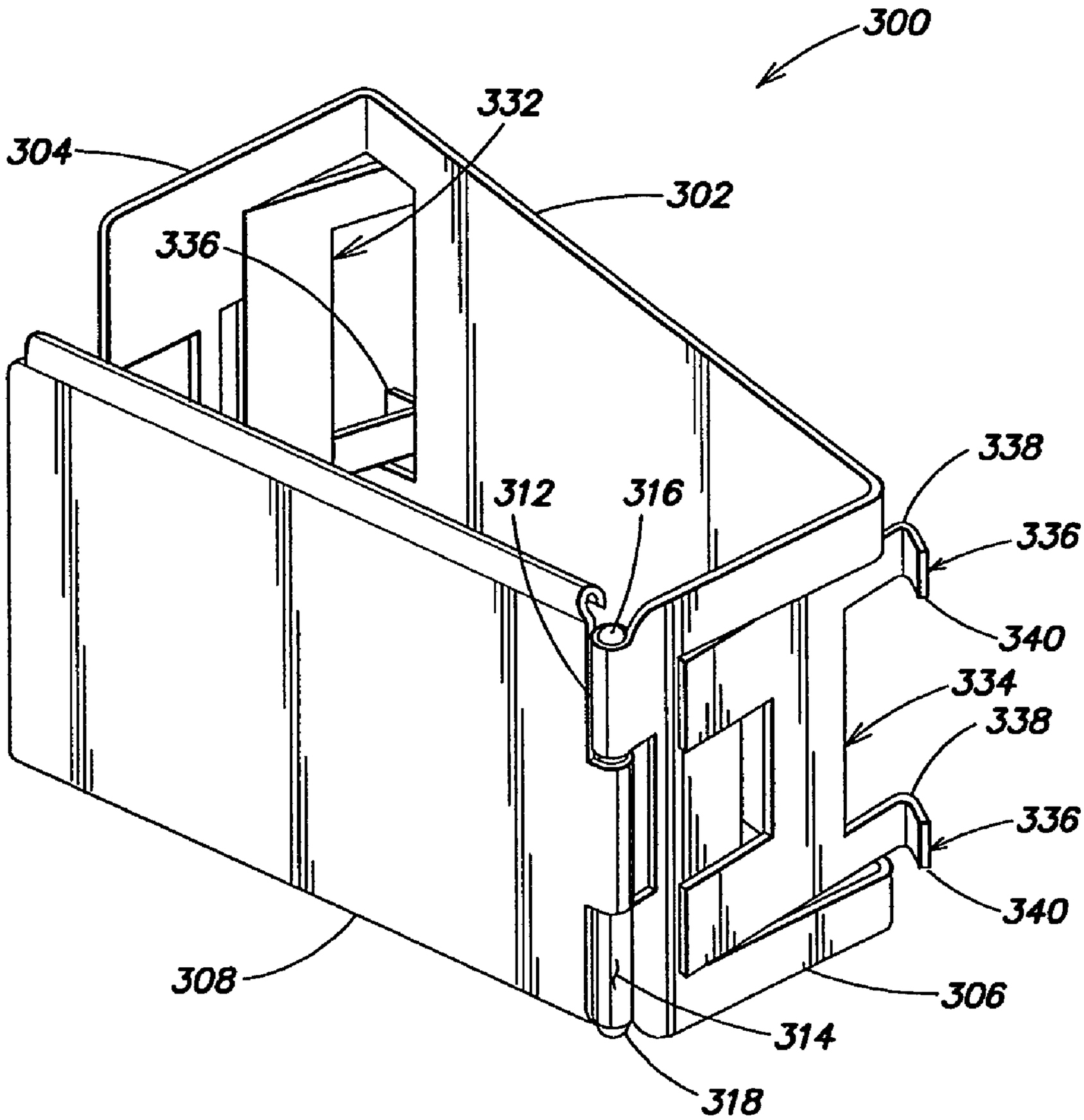
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FIG. 33

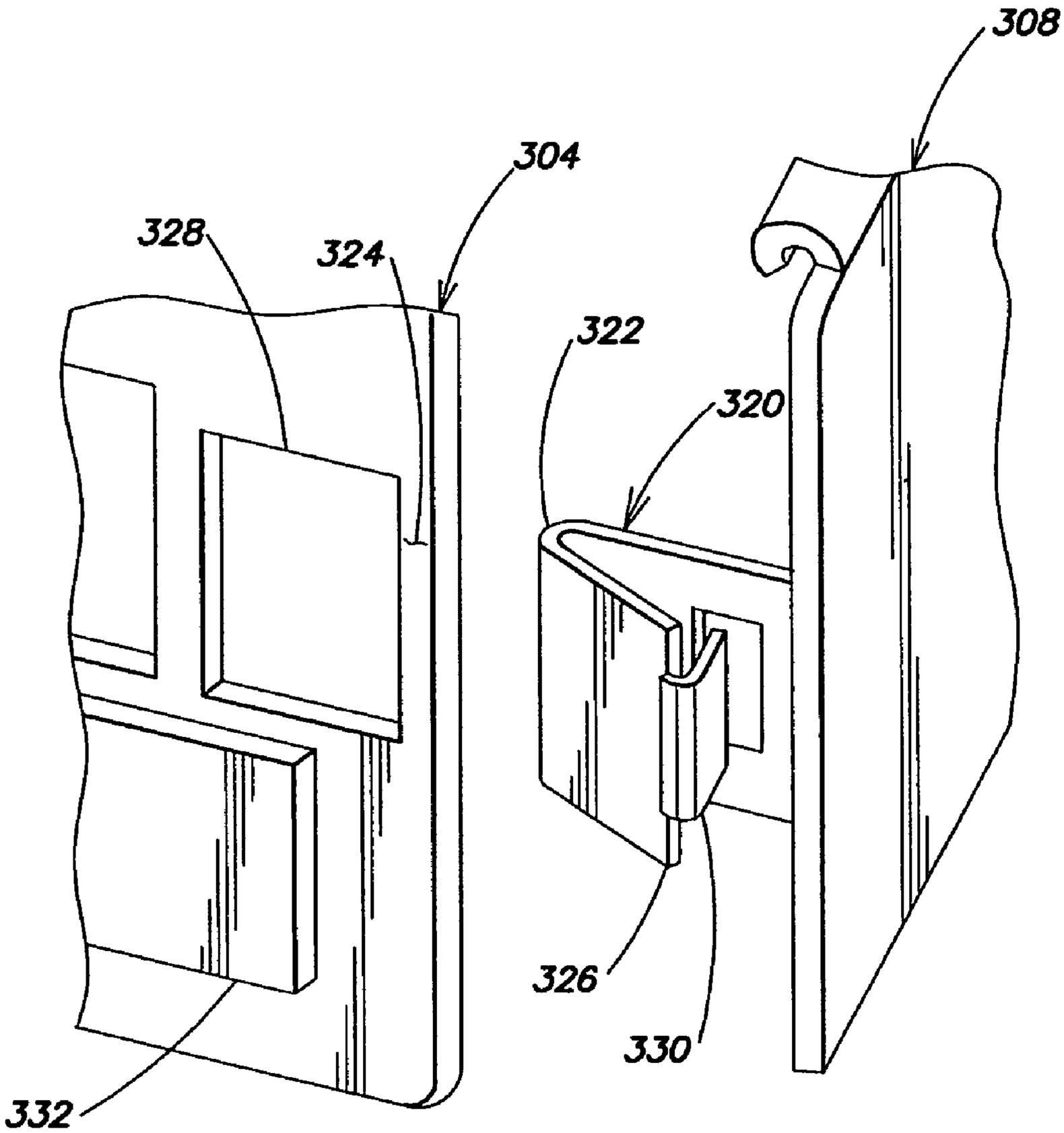

FIG. 34

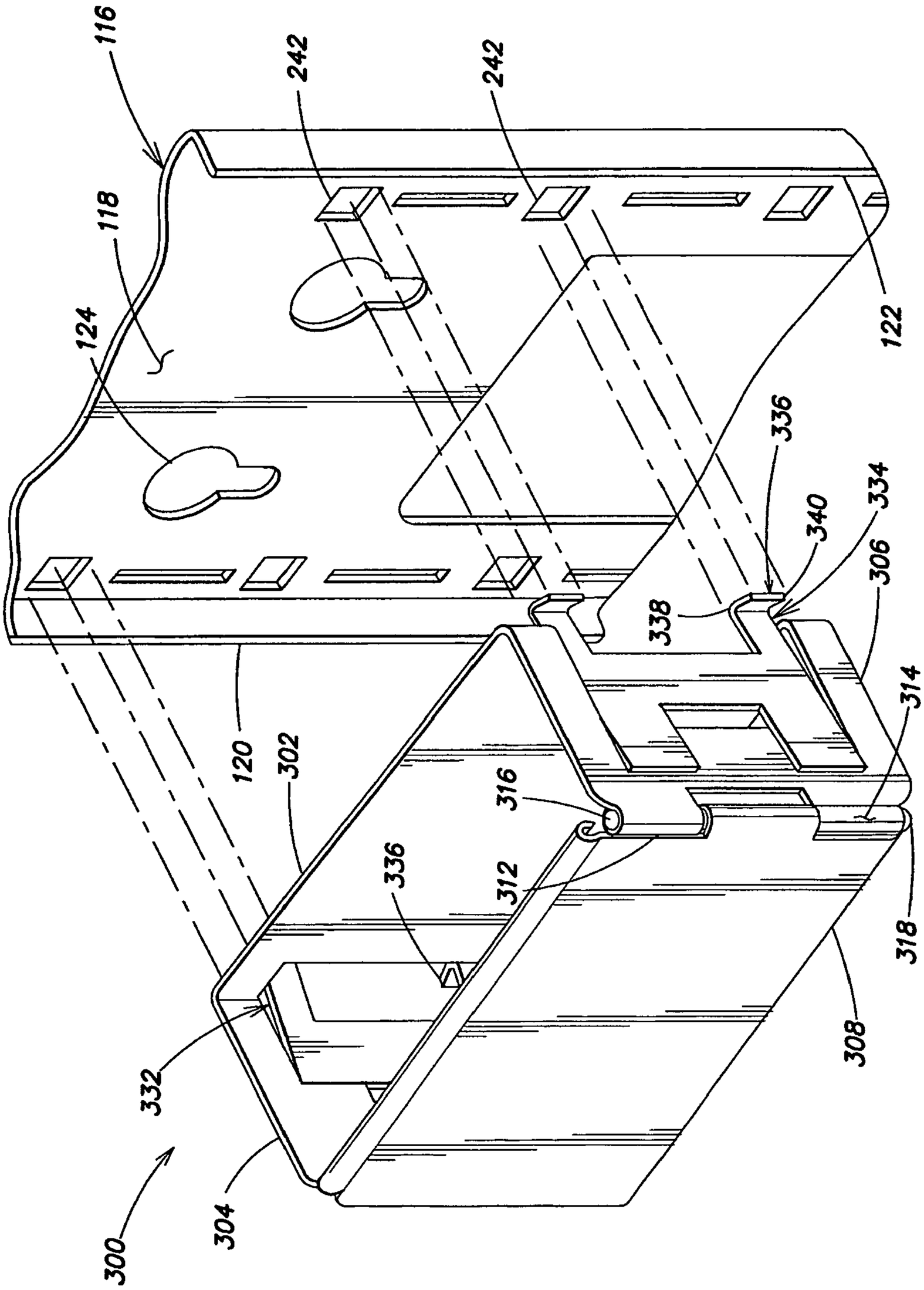
116
242
242
118
124
122
336
340
334
306
338
314
120
302
316
336
312
318
308
332
304
300

FIG. 35

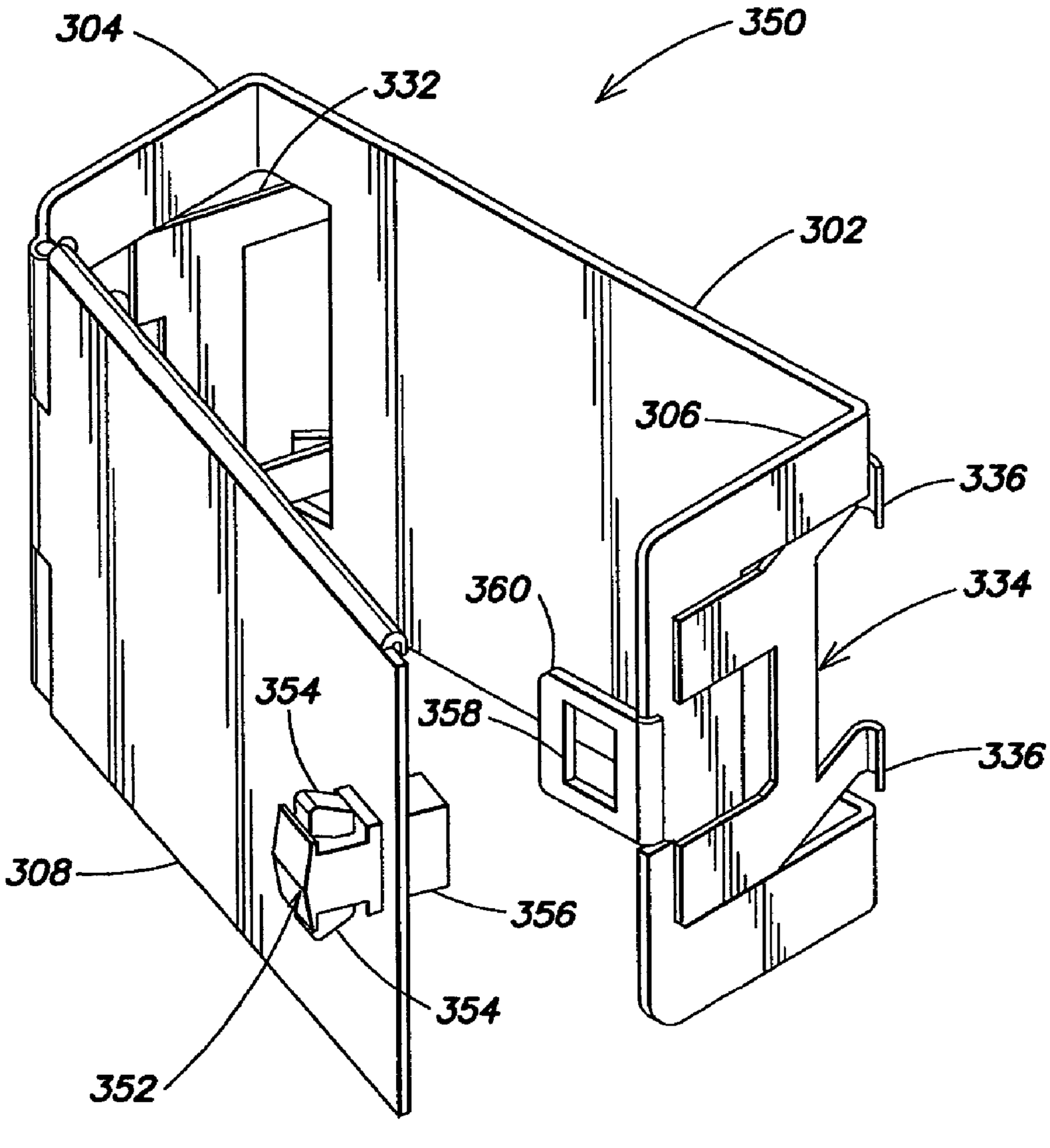

FIG. 36

EQUIPMENT ENCLOSURE KIT AND ASSEMBLY METHOD

RELATED APPLICATION

This application is a continuation-in-part of U.S. patent application Ser. No. 10/990,927, filed Nov. 17, 2004, entitled EQUIPMENT ENCLOSURE KIT AND ASSEMBLY METHOD, currently pending and incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to racks and enclosures, and more particularly to racks and enclosures used to house data processing, networking and telecommunications equipment.

2. Discussion of Related Art

Equipment enclosures for electronic equipment, such as data processing, networking and telecommunications equipment have been in use for years. Over the years, a number of different standards have been developed to enable equipment manufacturers to design rack mountable equipment that can be mounted in standard racks manufactured by different manufacturers. One such standard is the Electronic Industries Association's EIA-310-D standard which defines parameters for what has become an industry standard nineteen inch rack.

Nineteen inch racks are used extensively in data centers and other facilities. With the proliferation of the Internet, it is not uncommon for a data center to contain hundreds of these racks. Further, with the ever decreasing size of computer equipment, and in particular, computer servers, the number of electrical connectors mounted in each rack has been increasing, raising additional power distribution, cooling and cable distribution concerns at the rack level. With these increasing concerns, there is a need for equipment racks that are flexible enough to satisfy a variety of different requirements, capable of meeting industry standards, and sufficiently simple in design to be cost effective, given the quantities of these racks that may be used in a facility.

SUMMARY OF THE INVENTION

A first aspect of the invention is directed to an improved equipment enclosure for housing electronic components. The enclosure includes a front assembly having a front frame, the front assembly defining a front of the enclosure, and a rear assembly having a rear frame. The enclosure further includes at least two side brace members wherein each side brace member has a first end and a second, opposite end. A first connector is adapted to releasably connect the first end of one of the side brace members to the front frame. A second connector is adapted to releasably connect the second end of the one of the side brace members to the rear frame.

Embodiments of the enclosure may include a plurality of panels releasably attachable to at least one of the front frame, the rear frame, and one of the side brace members to cover open sides of the enclosure. At least one spring finger, coupled to one of the plurality of side panels and at least one of the front frame, the rear frame, and one of the side brace members, provides electrical continuity between the side panels and the at least one of the front frame, the rear frame, and one of the side brace members. Each connector may include an upper tab mounted on one of the front and rear frames, and a top flange formed on the one of the side brace members. The top flange has a downwardly opening channel adapted to receive the upper tab when connecting the one of the side brace members to the one of the front and rear frames.

Each connector may further include a lower tab mounted on the one of the front and rear frames, the lower tab having a boss formed thereon, and an opening formed in the one of the side brace members below the top flange. The opening is adapted to receive the boss therein when connecting the one of the side brace members to the one of the front and rear frames. Each connector may further include a channel member mounted on the one of the side brace members. The channel member is adapted to receive the one of the front and rear frames therein when connecting the one of the side brace members to the one of the front and rear frames. A fastener is attached to the one of the front and rear frames. The arrangement is such that the channel member has a finger projecting from the channel member, with the finger being adapted to hook onto the fastener. The fastener is adapted to be tightened to secure the finger in place.

At least one mounting flange may be releasably mounted on one of the side brace members within an interior of the enclosure. The at least one mounting flange is adapted to support equipment in the enclosure. The at least one mounting flange comprises a clamping assembly to releasably clamp the at least one mounting flange to the one of the side brace members. The clamping assembly comprises a clamping bracket having teeth formed along an upper edge of the clamping bracket. The teeth of the clamping bracket are adapted to mesh with teeth formed in the one of the side brace members to clamp the at least one mounting flange to the one of the side brace members. The clamping assembly further comprises a latch member connected to the clamping bracket. The latch member and the clamping bracket are positioned within a vertical slot formed in the at least one mounting flange, and moveable between a non-clamping position in which the teeth of the clamping bracket are spaced from the teeth of the one of the side brace members and a clamping position in which the teeth of the clamping bracket mesh with the teeth of the one of the side brace members. A viewing slot may be formed in the at least one mounting flange to view whether the latch member and clamping bracket are in the non-clamping position or the clamping position.

A positioning system may also be provided to position the at least one mounting flange within the enclosure. The positioning system includes at least two openings formed in the at least one mounting flange, and at least two different, alternating symbols which form a line of symbols along the one of the side brace members. The symbols and openings being constructed and arranged to show one symbol through one opening to indicate a position of the at least one mounting flange along the one of the side brace members. The positioning system includes three openings and three different symbols, the symbols and openings being constructed and arranged to show a different symbol through a different opening when moving the at least one mounting flange an incremental distance along the length of the one of the side brace members. The at least one mounting flange further may include a hook member adapted to ride along a lower edge of the one of the side brace members.

At least one cable organizer can be releasably mounted on one of the side brace members within an interior region of the enclosure. The cable organizer is adapted to support and tie-off cables. The at least one cable organizer includes a clamping assembly to releasably clamp the cable organizer to the one of the side brace members. The clamping assembly includes a clamping bracket having teeth formed along an upper edge of the clamping bracket. The teeth of the clamping bracket are adapted to mesh with teeth formed in the one of the side brace members to clamp the at least one cable orga-

nizer to the one of the side brace members. The clamping assembly further includes a fastener connected to the clamping bracket. The fastener and the clamping bracket are positioned within a vertical slot formed in the at least one cable organizer, and moveable between a non-clamping position in which the teeth of the clamping bracket are spaced from the teeth of the one of the side brace members and a clamping position in which the teeth of the clamping bracket mesh with the teeth of the one of the side brace members.

Other embodiments include a roof releasably attached to the front and rear frames. The roof has a first end and a second end opposite the first end with at least one tab formed at the first end of the roof. The tab is adapted to fit within a slot formed in one of the front and rear frames. The roof has at least one fastener provided at the second end of the roof, the fastener being adapted to be releasably inserted within an opening formed in the other frame of the front and rear frames. The roof may be formed with at least one cutout provided along an edge of the roof to receive a cable there through. The arrangement is such that the roof is removable from the enclosure without disconnecting the cable. A cutout cover may be provided to selectively cover the at least one cutout. The cutout cover includes a plurality of keys constructed and arranged to selectively cover the cutout. Each key has a retaining clip to releasably attach the key to the roof. At least one spring finger, coupled to one of the roof and one of the front and rear frames, provides electrical continuity between the roof and one of the front and rear frames. In another embodiment, at least one roof bridge member is releasably attached to the front and rear frames.

At least one leveling foot may be mounted on one of the front and rear frames. The leveling foot is adapted to level the enclosure, after receiving electronic components within the enclosure.

At least one hinge, coupled to the front frame, is adapted to releasably hinge a front door to the front frame. Specifically, the front frame includes a left side rail member and a right side rail member. The at least one hinge is reversible to mount on one of the left side rail member and the right side rail member of the front frame. Each hinge comprises a pin releasably mounted on one of the left and right side rail members and a barrel portion, adapted to receive the pin therein, mounted on the door. The pin is spring-loaded to enable the door to be removed without lifting the door off the hinges.

A second aspect of the invention is directed to an enclosure for housing electronic components. The enclosure includes a frame assembly having a front frame defining a front of the enclosure, a rear frame, and a plurality of side brace members connecting the front frame and the rear frame. A first pair of side brace members is positioned on one side of the front and rear frames and a second pair of side brace members is positioned on an opposite side of the front and rear frames. At least one mounting flange is releasably mounted on at least one side brace member of one of the first and second pairs of side brace members. At least one clamping assembly releasably clamps the at least one mounting flange to the at least one side brace member.

Embodiments of the enclosure may include at least one side brace member having teeth formed along a length of the at least one side brace member. The clamping assembly includes a clamping bracket having teeth formed along at least one edge of the clamping bracket. Specifically, the teeth of the clamping bracket are adapted to mesh with teeth formed in the at least one side brace member to clamp the at least one mounting flange to the at least one side brace member. The clamping assembly further includes a latch member connected to the clamping bracket. The latch member and the clamping bracket are positioned within a vertical slot formed in the at least one mounting flange, and moveable between a non-clamping position in which the teeth of the clamping bracket are spaced from the teeth of the at least one side brace member and a clamping position in which the teeth of the clamping bracket mesh with the teeth of the at least one side brace member. The latch member has a cam surface which engages the mounting flange to lock the clamping assembly in place. A viewing slot may be formed in the at least one mounting flange to view whether the latch member and clamping bracket are in the non-clamping position or the clamping position. A positioning system may be further provided to position the at least one mounting flange within the enclosure. The positioning system comprises at least two openings formed in the at least one mounting flange, and at least two different, alternating symbols which form a line of symbols along one of the first and second pairs of side brace members. The symbols and openings are constructed and arranged to show one symbol through one opening to indicate the position of the at least one mounting flange along the one of the first and second pairs of side brace members. The positioning system includes three openings and three different symbols. Specifically, the symbols and openings are constructed and arranged to show a different symbol through a different opening when moving the at least one mounting flange an incremental distance along a length of the one of the first and second pairs of side brace members.

At least one cable organizer may be releasably mounted on at least one side brace member of one of the first and second pairs of side brace members within an interior region of the enclosure. The cable organizer is adapted to support and tie-off cables. The at least one cable organizer includes a clamping assembly to releasably clamp the cable organizer to the at least one side brace member. The clamping assembly includes a clamping bracket having teeth formed along at least one edge of the clamping bracket. The teeth of the clamping bracket are adapted to mesh with teeth formed in the at least one side brace member to clamp the at least one cable organizer to the at least one side brace member. The clamping assembly further includes a fastener connected to the clamping bracket. The fastener and the clamping bracket are positioned within a vertical slot formed in the cable organizer, and moveable between a non-clamping position in which the teeth of the clamping bracket are spaced from the teeth of the at least one side brace member and a clamping position in which the teeth of the clamping bracket mesh with the teeth of the at least one side brace member.

A third aspect of the invention is directed to an enclosure comprising a frame assembly including a front frame defining a front of the enclosure, a rear frame, and a plurality of side brace members connecting the front frame and the rear frame. A first pair of side brace members is positioned on one side of the front and rear frames and a second pair of side brace members is positioned on an opposite side of the front and rear frames. At least one mounting flange is releasably mounted on at least one side brace member of one of the first and second pairs of side brace members. The enclosure further includes a positioning system to position the at least one mounting flange within the enclosure.

Embodiments of this aspect of the invention may include at least two different, alternating symbols which form a line of symbols along the at least one side brace member. The symbols are constructed and arranged to enable the positioning of the at least one mounting flange along the at least one side brace member. The positioning system further includes at least two openings formed in the at least one mounting flange.

Specifically, the positioning system comprises three openings and three different symbols. The symbols and openings are constructed and arranged to show a different symbol through a different opening when moving the at least one mounting flange an incremental distance along a length of the at least one side brace member. The at least one mounting flange includes at least one clamping assembly to releasably clamp the at least one mounting flange to the at least one side brace member. The at least one side brace member includes teeth formed along a length of the at least one side brace member. The clamping assembly comprises a clamping bracket having teeth formed along at least one edge of the clamping bracket. The teeth of the clamping bracket are adapted to mesh with teeth formed in the at least one side brace member to clamp the at least one mounting flange to the at least one side brace member. The clamping assembly further comprises a latch member connected to the clamping bracket. The latch member and the clamping bracket are positioned within a vertical slot formed in the at least one mounting flange, and moveable between a non-clamping position in which the teeth of the clamping bracket are spaced from the teeth of the at least one side brace member and a clamping position in which the teeth of the clamping bracket mesh with the teeth of the at least one side brace member. The latch member has a cam surface which engages the at least one mounting flange to lock the clamping assembly in place. A viewing slot may be formed in the at least one mounting flange to view whether the latch member and clamping bracket are in the non-clamping position or the clamping position.

A fourth aspect of the invention is directed to a kit for assembling at least one enclosure of the type capable of housing electronic components. The kit comprises components for assembling the at least one enclosure including a front assembly having a front frame, the front assembly defining a front of the enclosure, a rear assembly having a rear frame, and at least two side brace members. Each side brace member has a first end and a second end. A plurality of connectors connect the at least two side brace members to the front assembly and the rear assembly.

Embodiments of the kit may include the provision of a connector having an upper tab mounted on one of the front and rear frames, and a top flange formed on one of the at least two side brace members. The top flange has a downwardly opening channel adapted to receive the upper tab when connecting the one of the at least two side brace members to the one of the front and rear frames. Each connector further includes a lower tab mounted on the one of the front and rear frames, the lower tab having a boss formed thereon, and an opening formed in the one of the at least two side brace members below the top flange. The opening is adapted to receive the boss therein when connecting the one of the at least two side brace members to the one of the front and rear frames. Each connector further includes a channel member mounted on the one of the at least two side brace members. The channel member is adapted to receive the one of the front and rear frames therein when connecting the one of the at least two side brace members to the one of the front and rear frames. A threaded fastener is attached to the one of the front and rear frames. The channel member has a finger projecting from the channel member, with the finger being adapted to hook onto the threaded fastener.

At least one mounting flange may be releasably mounted on one of the at least two side brace members within an interior of the enclosure. The at least one mounting flange is adapted to support equipment in the enclosure. The at least one mounting flange comprises at least one clamping assembly to releasably clamp the mounting flange to the one of the at least two side brace members. Specifically, the one of the at least two side brace members includes teeth formed along a length of the one of the at least two side brace members. The clamping assembly comprises a clamping bracket having teeth formed along at least one edge of the clamping bracket. The teeth of the clamping bracket are adapted to mesh with the teeth formed in the one of the at least two side brace members to clamp the at least one mounting flange to the one of the at least two side brace members. The clamping assembly further comprises a latch member connected to the clamping bracket. The latch member and the clamping bracket are positioned within a vertical slot formed in the at least one mounting flange, and movable between a non-clamping position in which the teeth of the clamping bracket are spaced from the teeth of the one of the at least two side brace members and a clamping position in which the teeth of the clamping bracket mesh with the teeth of the one of the at least two side brace members. A viewing slot may be formed in the at least one mounting flange to view whether the latch member and clamping bracket are in the non-clamping position or the clamping position.

Embodiments of the kit may further include a positioning system to position the at least one mounting flange within the enclosure. The positioning system includes at least two openings formed in the at least one mounting flange, and at least two different, alternating symbols which form a line of symbols along one of the at least two side brace members. The symbols and openings are constructed and arranged to show one symbol through one opening to indicate the position of the at least one mounting flange along the one of the at least two side brace members. The positioning system includes three openings and three different symbols. The symbols and openings are constructed and arranged to show a different symbol through a different opening when moving the at least one mounting flange an incremental distance along a length of the one of the at least two side brace members.

At least one cable organizer may be releasably mounted on one of the at least two side brace members within an interior region of the enclosure. The cable organizer is adapted to support and tie-off cables.

The components include components for assembling a plurality of enclosures and a transport crate configured to contain the components during at least one of transport and storage. The transport crate is a box-like structure having a plurality of dividers positioned within an interior region of the transport crate to separate components for each of the plurality of enclosures.

The front assembly further includes a front door hinged on the front frame. At least one hinge is coupled to the front frame. The at least one hinge is adapted to releasably hinge the front door to the front frame. The at least one hinge comprises a pin releasably mounted on the front frame, and a barrel portion, adapted to receive the pin therein, mounted on the door. The pin is spring-loaded to enable the door to be removed without lifting the door off the at least one hinge. The rear assembly further includes at least one rear door hinged on the rear frame. At least one hinge is coupled to the rear frame. The at least one hinge is adapted to releasably hinge the rear door to the rear frame.

A fifth aspect of the invention includes a connector to releasably connect a first component to a second component. The connector includes an upper tab mounted on the first component, and a top flange formed on the second component. The top flange has a downwardly opening channel adapted to receive the upper tab when connecting the first component to the second component. A lower tab is mounted on the first component. The lower tab has a boss formed

thereon. An opening is formed in the second component below the top flange. The opening is adapted to receive the boss therein when connecting the one member to the other member.

Embodiments of the connector may further include a channel member mounted on the second component. The channel member is adapted to receive the first component therein when connecting the first component to the second component. The channel member has a finger projecting from the channel member with the finger being adapted to hook onto a fastener attached to the first component. The fastener is adapted to be tightened to secure the finger in place.

A sixth aspect of the invention is directed to a clamping assembly to releasably clamp a first component to a second component. The clamping assembly includes a clamping bracket having teeth formed along at least one edge of the clamping bracket. The teeth of the clamping bracket are adapted to mesh with teeth formed in the second component. The clamping assembly further includes a latch member connected to the clamping bracket. The latch member and the clamping bracket are positioned within a slot formed in the first component, and movable between a non-clamping position in which the teeth of the clamping bracket are spaced from the teeth of the second component and a clamping position in which the teeth of the clamping bracket mesh with the teeth of the second component to prevent any side-to-side movement of the first component with respect to the second component.

Embodiments of the clamping assembly may include the provision of a latch member having a cam surface which engages the first component to lock the clamping assembly in place. A viewing slot may be formed in the first component to view whether the latch member and clamping bracket are in the non-clamping position or the clamping position. A positioning system may be further included to position the first component with respect to the second component. Specifically, the positioning system comprises at least two openings formed in the first component, and at least two different, alternating symbols which form a line of symbols along the second component. The symbols and openings are constructed and arranged to show one symbol through one opening to indicate a position of the first component along the second component. In one embodiment, the positioning system comprises three openings and three different symbols. The symbols and openings are constructed and arranged to show a different symbol through a different opening when moving the first component an incremental distance along the length of the second component.

A seventh aspect of the invention is directed to a method of assembling components of an enclosure from a kit comprising the components. The components include a front rectangular frame, a rear rectangular frame, and four side brace members. Each side brace member has opposite ends. The method comprises, for each side brace member, connecting one end of the side brace member to a respective corner of the front frame, and connecting an opposite end of the side brace member to a respective corner of the rear frame. The step of connecting each end of a side brace member to a respective corner of one of the front frame and the rear frame comprises selecting at least one of positioning a flange provided on one of the side brace member and one of the front frame and the rear frame over a tab provided on the other of the side brace member and one of the front frame and the rear frame, inserting a boss formed on a second tab provided on one of the frame and the side brace member into an opening formed the other of the frame and the side brace member, and positioning the frame within a channel member mounted on the side brace member.

Connecting each end of a side brace member to a respective corner of one of the front frame and the rear frame may further include hooking a finger of the channel member over a fastener secured to the one of the front frame and the rear frame. The method may also include releasably clamping a mounting flange to a side brace member, and positioning the mounting flange within the enclosure with a positioning system.

An eighth aspect of the invention is directed to an electrical connector for connecting an electrical component to a second component. The electrical connector includes a U-shaped body adapted to lie along a plane and having a pair of oppositely extending flanges. The flanges are adapted to be secured to the second component. A tab is integrally formed with the body and so that the tab extends along the same plane as the body. The arrangement being such that the body protects the tab during use.

Embodiments of the electrical connector may include means for attaching the electrical connector to the second component. Specifically, the means for attaching the electrical connector to the second component includes a weld. The means for attaching the electrical connector to the second component may further include an opening formed in one of the flanges. The opening is sized for receiving a fastener therein. A positioning tab is formed on the other flange. The arrangement is such that the positioning tab is received within a slotted opening formed in the second component.

A ninth aspect of the invention is directed to an enclosure for housing electronic components. The enclosure includes a front assembly having a front frame, the front assembly defining a front of the enclosure, a rear assembly having a rear frame, at least two side brace members, each side brace member having a first end and a second, opposite end, first connector means to releasably connect the first end of one of the side brace members to the front frame, and second connector means to releasably connect the second end of the one of the side brace members to the rear frame.

Embodiments of the first and second connector means for the enclosure may include an upper tab mounted on one of the front and rear frames, and a top flange formed on the one of the side brace members. The top flange has a downwardly opening channel adapted to receive the upper tab when connecting the one of the side brace members to the one of the front and rear frames. Each of the first connector means and the second connector means may further include a lower tab mounted on the one of the front and rear frames. The lower tab has a boss formed thereon. An opening is formed in the one of the side brace members below the top flange. The opening is adapted to receive the boss therein when connecting the one of the side brace members to the one of the front and rear frames. Each of the first connector means and the second connector means may further include a channel member mounted on the one of the side brace members. The channel member is adapted to receive the one of the front and rear frames therein when connecting the one of the side brace members to the one of the front and rear frames. Each of the first connector means and the second connector means may further include a fastener attached to the one of the front and rear frames. The channel member has a finger projecting from the channel member. The finger is adapted to hook onto the fastener.

A tenth aspect of the invention is directed to an enclosure for housing electronic components. The enclosure includes a frame assembly having a front frame defining a front of the enclosure, a rear frame, and a plurality of side brace members

connecting the front frame and the rear frame. A first pair of side brace members is positioned on one side of the front and rear frames and a second pair of side brace members is positioned on an opposite side of the front and rear frames. At least one mounting flange is releasably mounted on at least one side brace member of one of the first and second pairs of side brace members. Clamping means is provided to releasably clamp the at least one mounting flange to the at least one side brace member.

Embodiments of the enclosure further include the provision of the at least one side brace member having teeth formed along a length of the at least one side brace member. The clamping means comprises a clamping bracket having teeth formed along at least one edge of the clamping bracket. The teeth of the clamping bracket are adapted to mesh with teeth formed in the at least one side brace member to clamp the at least one mounting flange to the at least one side brace member. The clamping means further comprises a latch member connected to the clamping bracket. The latch member and the clamping bracket are positioned within a slot formed in the at least one mounting flange and moveable between a non-clamping position in which the teeth of the clamping bracket are spaced from the teeth of the at least one side brace member and a clamping position in which the teeth of the clamping bracket mesh with the teeth of the at least one side brace member. The latch member has a cam surface which engages the mounting flange to lock the clamping assembly in place. A viewing slot is formed in the at least one mounting flange to view whether the latch member and clamping bracket are in the non-clamping position or the clamping position.

An eleventh aspect of the invention is directed to an enclosure for housing electronic components. The enclosure includes a frame assembly comprising a front frame defining a front of the enclosure, a rear frame, and a plurality of side brace members connecting the front frame and the rear frame. A first pair of side brace members is positioned on one side of the front and rear frames and a second pair of side brace members is positioned on an opposite side of the front and rear frames. At least one mounting flange is releasably mounted on at least one side brace member of one of the first and second pairs of side brace members. Positioning means is provided to position the at least one mounting flange within the enclosure.

Embodiments of the enclosure include the provision of the positioning means having at least two openings formed in the at least one mounting flange, and at least two different, alternating symbols which form a line of symbols along a side brace member of one of the first and second pairs of the side brace members. The symbols and openings are constructed and arranged to show one symbol through one opening to indicate the position of the at least one mounting flange along the side brace member. Specifically, the positioning means comprises three openings and three different symbols. The symbols and openings are constructed and arranged to show a different symbol through a different opening when moving the at least one mounting flange an incremental distance along a length of the one of the side brace member.

A twelfth aspect of the invention is directed to a method of assembling components of an enclosure from a kit comprising the components. The components include a front rectangular frame, a rear rectangular frame, and four side brace members. Each side brace member has opposite ends. The method includes, for each side brace member, connecting one end of the side brace member to a respective corner of the front frame, and connecting an opposite end of the side brace member to a respective corner of the rear frame. The method further includes positioning a mounting flange within the enclosure with a positioning system, and releasably clamping the mounting flange to at least one side brace member.

Embodiments of the method may further include releasably clamping two mounting flanges within the enclosure in facing relation with one another to at least two side brace members.

A thirteenth aspect of the invention is directed to a method of providing multiple enclosures, each enclosure comprising a kit of components including a front rectangular frame, a rear rectangular frame, four side brace members, a roof, and at least two mounting flanges. The method includes arranging the components of each kit in a compact configuration, and disposing the multiple enclosures in a transport crate.

Embodiments of the method may further include transporting the transport crate to an end user, assembling the components of each kit in the form of an enclosure, and/or storing the transport crate. The step of arranging the components of each kit in a compact configuration may include positioning the side brace members, roof and at least two mounting flanges between the front rectangular frame and the rear rectangular frame.

A fourteenth aspect of the invention is directed to an enclosure including a frame constructed and arranged to define an interior region. The frame has at least one support member with a plurality of threaded openings formed therein. The enclosure further includes a plurality of leveling feet mounted on the at least one support member of the frame. The leveling feet are adapted to level the enclosure after receiving electronic components within the enclosure. Each leveling foot includes a threaded rod threadably received within the threaded openings of the support member, and a foot portion pivotably connected to the threaded rod. The threaded rod is constructed and arranged to raise and lower the leveling foot by manipulating the leveling rod above the leveling foot.

A fifteenth aspect of the invention is directed to enclosure for housing electronic components having a door and a frame constructed and arranged to define an interior region. The frame includes a door frame assembly having a top rail member, a bottom rail member spaced below the top rail member, a left side rail member adapted to connect the top rail member and the side rail member, and a right side rail member adapted to connect the top rail member and the side rail member. The enclosure further includes hinge means for selectively hinging the door on one of the left side rail member and the right side rail member. The door is operable between an open position to allow access into the interior region of the enclosure and a closed position to prevent access into the interior region of the enclosure. The hinge means is constructed and arranged to prevent the door from being removed from the hinge means when the door is in a closed position.

Embodiments of the enclosure may include the provision of the hinge means being reversible to attach to one of the left side rail member and the right side rail member. Specifically, the hinge means includes a pin portion releasably mounted on one of the left and right side rail members and the door, and a barrel portion, adapted to receive the pin therein, mounted on the other of the left and right side rail members and the door.

A sixteenth aspect of the present invention is directed to a kit for assembling at least one enclosure of the type capable of housing electronic components. The kit includes components for assembling the at least one enclosure including a front assembly having a front frame, the front assembly defining a front of the enclosure, a rear assembly having a rear frame, and at least two side brace members. Each side brace member has a first end connected to one of the front frame and the rear frame and a second end connected to the other of the front frame and the rear frame. At least one mounting flange is

releasably mounted on one of the at least two side brace members within an interior of the enclosure. The at least one mounting flange is adapted to support equipment in the enclosure. The kit further includes a data port assembly secured to the mounting flange, the data port assembly having at least one data port.

In one embodiment of the kit, the mounting flange has an opening formed therein, and the data port assembly includes an insert constructed and arranged to fit within the opening to secure the insert to the mounting flange. The data port assembly further includes a connector head received by the insert, the connector head having the at least one data port.

A seventeenth aspect of the invention is directed to a containment bracket for encasing a cable or wire within an enclosure designed to house electrical components. The containment bracket comprises a housing having an interior region, the housing being attached to the enclosure. The containment bracket further comprises a door coupled to the housing to access the interior region of the housing.

In an embodiment of the containment bracket, the containment bracket further comprises at least one latch coupled to the housing. The at least one latch is constructed and arranged to be releasably secured to the enclosure. The latch includes an end portion adapted to releasably engage the enclosure. The housing includes a back wall, and at least one side wall extending from the back wall. The door is hingedly mounted on the at least one side wall. The containment bracket comprises a door latch member coupled to the door to releasably secure the door to the housing.

An eighteenth aspect of the invention is directed to a containment bracket for encasing a cable or wire within an enclosure designed to house electrical components. The containment bracket comprises a housing having an interior region, the housing being attached to the enclosure, and means, coupled to the housing, for accessing the interior region of the housing.

In an embodiment of the containment bracket, the containment bracket further comprises means, coupled to the housing, for releasably securing the housing to the enclosure. The means for releasably securing the housing to the enclosure comprises at least one latch constructed and arranged to be releasably secured to the enclosure. The housing includes a back wall and at least one side wall extending from the back wall. The means for accessing the interior region of the housing comprises hingedly mounting a door on the at least one side wall. The means for accessing the interior region of the housing further comprises a door latch member to releasably secure the door to the housing.

A nineteenth aspect of the present invention is directed to a method for encasing a cable or wire within an enclosure designed to house electrical components. The method comprises: releasably mounting at least one containment bracket to the enclosure, the containment bracket having an interior region and a selectively open front to allow access to the interior region; positioning a cable or wire within the interior region of the at least one containment bracket through the open front of the at least one containment bracket; and enclosing the open front of the at least one containment bracket.

Embodiments of the method are directed to the provision of the at least one containment bracket including a housing and a door hingedly coupled to the housing. The step of enclosing the open front of the containment bracket includes closing the door with respect to the housing to encase the cable. The step of releasably mounting at least one containment bracket within the enclosure comprises releasably mounting a plurality of containment brackets within the enclosure in aligned relation with one another to define an elongate channel. The method further comprises positioning the at least one containment bracket on a support within the enclosure.

A twentieth aspect of the invention is directed to an enclosure for housing electronic components, the enclosure comprising a frame assembly comprising a plurality of frame members defining an interior region of the enclosure. The enclosure further comprises a support attached to at least one frame member within the interior region of the enclosure, and a containment bracket for encasing a cable or wire to the support. The containment bracket comprises a housing having an interior region, and a door coupled to the housing to access the interior region of the housing.

Embodiments of the enclosure include at least one latch coupled to the housing. The at least one latch is constructed and arranged to be releasably secured to the support. The enclosure further comprises at least one electronic component support member releasably mounted on at least one frame member, and, in certain embodiments, at least one clamping assembly to releasably clamp the at least one electronic component support member to the at least one frame member. The support comprises at least one cable organizer releasably mounted on the at least one frame member within an interior region of the housing of the enclosure. The cable organizer is adapted to support the cable containment bracket. The at least one cable organizer comprises a clamping assembly to releasably clamp the cable organizer to the at least one frame member.

The present invention will be more fully understood after a review of the following figures, detailed description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, reference is made to the figures which are incorporated herein by reference and in which:

FIG. **1** is a perspective view of an enclosure of an embodiment of the present invention;

FIG. **2** is an exploded perspective view of the enclosure illustrated in FIG. **1** in a pre-assembled condition;

FIG. **3** is an enlarged perspective view of a connector of components of the enclosure of an embodiment of the present invention;

FIG. **4** is a view similar to FIG. **3** showing the components connected to one another;

FIG. **5** is a perspective view of the enclosure with mounting flanges of an embodiment of the present invention illustrated in a pre-installed position;

FIGS. **6-11** are enlarged views of a clamping assembly of an embodiment of the present invention used to mount the mounting flanges;

FIG. **11**A is an enlarged perspective view of a mounting flange of an embodiment of the invention;

FIG. **11**B is an enlarged perspective view of a mounting flange of another embodiment of the invention;

FIG. **11**C is an enlarged perspective view of the mounting flange shown in FIG. **11**B taken from another perspective;

FIG. **12** is a perspective view of the enclosure with cable organizers of an embodiment of the present invention in an installed position;

FIG. **13** is an enlarged perspective view of the cable organizer illustrated in FIG. **12**;

FIG. **14** is a perspective view of a cover panel or roof of the enclosure of an embodiment of the present invention;

FIG. **15** is a view similar to FIG. **14** illustrating the roof in a pre-installed position;

FIG. **15**A is a bottom perspective view of an end of the roof;

FIG. **16**A is an enlarged top perspective view of a cutout cover of an embodiment of the present invention;

FIG. **16**B is a bottom perspective view of the cutout cover illustrated in FIG. **16**A;

FIG. **17** is a perspective view showing a pair of roof bridge members of an embodiment of the present invention;

FIG. **18** is an enlarged perspective view of an end of the roof bridge member shown in FIG. **17**;

FIG. **19** is a perspective view of the enclosure illustrating side panels of a preferred embodiment of the present invention;

FIG. **20** is a perspective view of a side panel of an embodiment of the present invention in a pre-installed position;

FIG. **20**A is an enlarged cross-sectional view of the side panel and a side brace member shown in a pre-installed position;

FIG. **20**B is an enlarged cross-sectional view of the side panel shown in an installed position on the side brace member;

FIGS. **20**C and **20**D are enlarged perspective views of a lock assembly of an embodiment of the present invention;

FIG. **21** is an enlarged perspective view of the enclosure showing a leveling foot of an embodiment of the present invention;

FIG. **21**A is an enlarged bottom perspective view of the enclosure showing the leveling foot and a caster of an embodiment of the present invention;

FIG. **21**B is an enlarged perspective view of the leveling foot;

FIG. **22** is a perspective view of a door assembly of an embodiment of the present invention;

FIG. **23** is an enlarged perspective view of a hinge of the door assembly;

FIG. **23**A is a perspective view of the door assembly prior to its attachment to a door frame;

FIG. **24** is a perspective view of a rear door assembly of an embodiment of the present invention;

FIGS. **25** and **26** are front and rear perspective views of a lock assembly of an embodiment of the present invention;

FIG. **27** is an enlarged perspective view of an electrical connector having a tab adapted to receive an electrical connection;

FIG. **27**A is a perspective view of the electrical connector shown in FIG. **27** mounted on a panel;

FIG. **28** is an enlarged perspective view of an electrical connector of another preferred embodiment;

FIG. **29** is an exploded perspective view of a kit of an embodiment of the present invention; and

FIG. **30** is a perspective view of a transport crate of an embodiment of the present invention.

FIG. **31** is a perspective view of a cable containment bracket of an embodiment of the invention mounted on a cable organizer;

FIG. **32** is a perspective view of the cable containment bracket shown in FIG. **31**;

FIG. **33** is a perspective view of a door of the cable containment bracket in a partially open position;

FIG. **34** is an enlarged perspective view showing a door latch assembly of the cable containment bracket to maintain the door in a closed position;

FIG. **35** is a perspective view illustrating the containment bracket and cable organizer in a disassembled condition; and

FIG. **36** is a perspective view of a cable containment bracket of another embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

For the purposes of illustration only, and not to limit the generality, the present invention will now be described in detail with reference to the accompanying figures. This invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," "having," "containing" "involving," and variations thereof herein, is meant to encompass the items listed thereafter and equivalents thereof as well as additional items.

Referring to the drawings, and more particularly to FIG. **1**, there is generally indicated at **10** an enclosure in accordance with at least one embodiment of the present invention to house electronic equipment, such as data processing and networking equipment (e.g., servers, server blades, associated power distribution equipment, etc.) and telecommunication equipment. In one embodiment of the present invention, the enclosure **10** is provided in the form of a kit, which can be easily assembled with the use of simple tools, e.g., a screwdriver, if any, and without difficult manipulation. When assembled, the enclosure **10** is a rectangular, box-like structure that is configured such that it can be assembled with or connected to other, similarly-shaped structures. The enclosure **10** has a front door assembly **12**, a rear door assembly **14**, a pair of side walls **16**, **18**, a bottom wall **20** and a top cover or "roof" panel **22**. As will be disclosed in greater detail below, the enclosure **10** is adjustably configurable to accommodate equipment having a variety of shapes and sizes. In addition, as alluded to above, the enclosure **10** can be conveniently broken down and disassembled for transport or storage. In at least one embodiment, the equipment enclosure may accommodate standard nineteen inch rack mountable equipment.

Referring to FIG. **2**, a frame assembly of the enclosure **10** is generally indicated at **24**. As shown, in at least one embodiment, the front and rear door assemblies **12**, **14**, which may be provided as part of the kit, which will be described in greater detail below, are completely assembled. More particularly, the front door assembly **12** includes a front door **26**, and a front door frame defined by top and bottom rail members **28**, **30**, and two side rail members **32**, **34**, with the front door being hinged on one of the side rail members, e.g., side rail member **32**. The rear door assembly **14** has two outwardly opening rear doors **36**, **38**, and a rear door frame defined by top and bottom rail members **40**, **42**, and two side rail members **44**, **46**, each rear door being hinged on a respective side rail member. The manner in which the front door **26** and rear doors **36**, **38** are hinged on their respective side rail members (i.e., side rail members **32**, **44** and **46**) and locked to provide a secure enclosure will be discussed in greater detail below. Also, it should be understood that the front door can be installed on the rear door frame and the rear doors can be installed on the front door frame, depending on the desired configuration of the enclosure.

The front and rear door assembles **12**, **14** are attached to one another by six side brace members, each indicated at **48**. It should be understood that fewer or more than six side braces can be provided to assemble the front and rear door

assemblies. For example, for shorter enclosures, four side braces are used to attach the front and rear door assemblies. As shown, two of the six side brace members **48** are provided to attach the door assemblies **12**, **14** at the top of the front and rear door frames. Similarly, two side brace members **48** attach the door assemblies **12**, **14** at the bottom of the front and rear door frames. Lastly, two side brace members **48** are positioned approximately halfway along the length of the side rail members of the front and rear door frames. In addition to connecting the front and rear door assemblies **12**, **14** to one another, the attachment of the ends of the side brace members **48** to their respective front and rear door assemblies, as will be discussed in greater detail below, provide the requisite bracing and support to the enclosure **10**, which enables the enclosure to house relatively heavy articles, such as servers and server blades.

The rail members of the front and rear door assemblies **12**, **14** and the side brace members **48** are fabricated from any suitable lightweight, rigid material, such as, but not limited to, steel or aluminum. It should be noted that the chosen material, in addition to being lightweight and rigid in construction, should be reasonable in cost and easy to fabricate. In at least one embodiment of the present invention, it is desirable to use materials having a conductive finish to allow grounding of the electronic components housed within the enclosure **10** and to allow all conductive portions of the enclosure **10** to be grounded.

Turning to FIGS. **3** and **4**, and more particularly to FIG. **3**, the manner in which the side brace members **48** are attached to the front and rear door assemblies **12**, **14** will be described in greater detail. Although FIGS. **3** and **4** illustrate the connection of the upper left-hand side brace member **48** as it is attached to the top rail member **40** and the side rail member **44** of the rear door assembly **14**, the principles described herein apply to the connection of the ends of the other side brace members **48** to their respective frame members. As shown, a connector **50** comprises two tabs **52**, **54** mounted on the left side rail member **44** of the rear door assembly **14**, e.g., by a welding process. The upper tab **52** is formed from blank material whereas the lower tab **54** has an outwardly projecting boss **56** formed thereon. The boss **56** is formed to have a centrally located threaded opening **58**, the purpose of which will be described below. Although it is envisioned that the boss **56** embodies a press-on nut, the boss can be integrally formed in the lower tab **54**.

The side brace member **48** has a top flange **60**, which defines a downwardly opening channel **62** adapted to receive the upper tab **52** in the manner illustrated in FIG. **4**. An opening **64** is formed in the side brace member **48** adjacent an end **66** of the side brace member just below the top flange **60**. The position of the opening **64** is such that it is aligned with, and adapted to receive therein, the boss **56** when the side brace member **48** is connected to the rear door assembly **14** in the manner illustrated in FIG. **4**. The boss **56** and the opening **64** are constructed to accurately position and square the side brace member on frame of the door assembly. Once assembled, a suitable threaded fastener (not shown), such as a machine screw, can be used to securely attach the side brace member **48** to the rear door assembly **14** by inserting the threaded fastener through the opening **64** and threading the fastener within the threaded opening **58** provided in the boss **56**.

To provide further stability, each connector **50** also comprises a U-shaped channel member **68** having an inwardly projecting finger **70** that is provided below the opening **64**. The channel member **68** is adapted to fit around the left side rail member **44** of the door assembly **14**, while the finger **70** slips over and hooks a threaded fastener **72** (e.g., a machine screw). As shown, the threaded fastener **72** is suitably fastened to the left side rail member **44** in the manner depicted in FIG. **4** so that a head of the threaded fastener is spaced from the side rail member. Other embodiments may include, especially when the strength of the connection is not a concern, using a slot and tab arrangement, such as a bridge lance or a shoulder rivet. Specifically, the finger **70** is slipped over a threaded portion of the threaded fastener **72** and is secured in place between the head of the threaded fastener and the side rail member **44**. Once assembled, the threaded fastener **72** can be tightened to further secure the side brace member **48** to the rear door assembly **14**.

Referring to FIG. **5**, after assembling the front and rear door assemblies **12**, **14** with the six side brace members **48** (or four side brace members, as required), several mounting flanges, each generally indicated at **74**, are mounted on the side brace members. It should be understood that although the mounting flanges **74** are shown outside the enclosure in FIG. **5** for illustration purposes, the mounting flanges are mounted within the interior region of the enclosure **10**. Also, although four mounting flanges **74** are illustrated in FIG. **5**, it should be understood that any number of mounting flanges can be provided to optimize the interior region defined by the enclosure **10** and to provide the requisite support for the electrical components housed within the enclosure. The mounting flanges **74** are adapted to support electronic components and/or shelves that support the electrical components.

Turning to FIG. **6**, each mounting flange **74** is generally L-shaped in construction, having one leg portion **76** adapted to be attached in the manner described below to the side brace members **48**. The other leg portion **78** of the mounting flange **74** has a plurality of vertically aligned openings **80** as defined by EIA-310-D, which are designed to mount servers and/or accessories in the well known manner. The openings **80** can also be threaded to receive support members directly therein. Additionally, the other leg **78** has a plurality of cutouts **82** adapted to tie-off objects within the interior of the enclosure **10**. Although the mounting flanges **74** are designed to support electrical components (e.g., servers) within the interior region of the enclosure **10**, they also may provide additional stability to the enclosure since each mounting flange is capable of being secured to three side brace members **48** (or two side brace members, or more than three side brace members, when so configured).

With reference to FIGS. **6-11**, the connection of the mounting flanges **74** to the side brace members **48** will be described in detail. Each mounting flange **74** is provided with three clamping assemblies (when three side braces are provided), each generally indicated at **84**, one for each side brace member **48**. Each clamping assembly **84** is disposed within a vertical slot **86** formed in the leg portion **76** of the mounting flange **74**, and is constructed to move longitudinally along the length of the slot. Thus, one clamping assembly **84** is positioned adjacent to the upper end of the mounting flange **74**, a second clamping assembly is positioned adjacent to the lower end of the mounting flange, and the third clamping assembly is positioned at the middle of the mounting flange. The clamping assembly **84** includes a clamping bracket **88** and a latch member **90** connected to the clamping bracket by a threaded fastener **92** and mating nut fastener **94** (FIG. **7**). As described in greater detail below, the latch member **90** is pivotable between a locked position in which the clamping assembly is secured to the leg portion **76** of the mounting flange **74** and an unlocked position in which the clamping assembly is movable within the slot **86** for allowing the mounting flange to be moved to another location within the enclosure.

The latch member **90** is illustrated in FIG. **6** in a locked position in which the clamping assembly **84** is tightened to ensure there is no movement of the latch member up and down within the slot **86** (see arrow A). Although not shown, by simply pivoting the latch member **90** so that it is generally disposed perpendicular to the plane of the mounting flange **74**, the clamping bracket **88** can be released to the unlocked position so that the clamping assembly **84** moves up and down within the slot **86**. Specifically, the latch member **90** has a cam surface **96**, which engages the body of the mounting flange **74** when pivoting the latch member to the position illustrated in FIG. **6**, thereby drawing the clamping bracket **88** toward the mounting flange. The result is that the mounting flange **74** is tightly captured between the clamping bracket **88** and the latch member **90**. The latch member **90** may be provided by SouthCo, Inc. under model no. 19-99-271. A rubber washer **98**, disposed between the nut fastener **94** and the clamping bracket **88**, provides the requisite resiliency to enable the cam action of the latch member **90** to lock the clamping bracket in place. It should be noted that a person having ordinary skill in the art, given the benefit of the instant disclosure, could employ another type of fastener, such as a thumb screw, to secure the mounting flange **74** between the clamping bracket **88** and the latch member **90**.

Further, as illustrated in the drawings, each of the clamping assemblies includes a hook member **100** that is adapted to ride along a lower edge **102** of the side brace member **48** as shown in FIG. **11**. The hook members **100** of the clamping assemblies **84** enable the sliding action of the mounting flange **74** along the side brace members **48** when positioning the mounting flange. Specifically, the hook members **100** function as load-bearing members that carry the weight of any equipment supported by the mounting flanges on to the frame assembly. The clamping brackets **88** prevent the mounting flanges **74** from moving from the front of the enclosure **10** to the rear of the enclosure and vice versa. In one embodiment of the invention, the hook members **100** can be designed so that any two hook members provided on an individual mounting flange **74** can carry the full weight of the mounting flange and any equipment supported by the mounting flange. This makes the mounting flange **74** easier to position and easier to manipulate during assembly of the enclosure **10**.

The arrangement is such that the mounting flanges **74** may be secured at different locations along the side brace members **48** based on the depth of the electronic equipment to be contained within the enclosure **10**. Specifically, each hook member **100** is slid over the edge **102** of its respective side brace member **48**, the hook member facilitating the side-to-side sliding movement of the mounting flange **74** along the side brace members. The upper surface of the clamping bracket **88** has a plurality of teeth **104** formed therein, which mate with teeth **106** formed near the upper edge of the side brace member **48**. In the embodiment shown, the incremental distance between each tooth is 0.250 inch. Thus, by moving the clamping bracket **88** one tooth length in either direction, the position of the mounting flange **74** is moved 0.250 inch. It should be understood that the size of the teeth **104**, **106** and the incremental distance between the teeth can be manipulated to achieve various spacing between teeth. Also, the mating teeth can alternatively be constructed so that the teeth are formed along the bottom edge of the clamping bracket and along the lower edge of the side brace member. In addition, the teeth can be formed along an edge of the hook member. One advantage associated with this construction is that, unlike prior art racks, the mounting flanges of an embodiment of the present invention can be adjusted over the entire depth of the rack without removing any fasteners.

To lock the clamping assembly **84** in place, the clamping assembly is raised by pivoting the latch member **90** so that it is unlocked, and lifting the latch member so that the teeth **104** of the clamping bracket **88** mesh with the teeth **106** of the side brace member **48**. The mating of the teeth **104**, **106** prevents any side-to-side movement of the mounting flange **74** with respect to the side brace member **48**. Next, the latch member **90** is rotated in the manner described above so that it generally lies along the same plane as the mounting flange **74** as shown in FIG. **9** to secure the clamping assembly **84** to the mounting flange. The mating of the teeth **104** of the clamping bracket **88** with the teeth **106** of the side brace member **48** prevents any lateral movement of the mounting flange **74** with respect to the side brace member. An oval slot **108** serves as a viewing window to enable an installer to ensure that the teeth **104** of the clamping bracket **88** mesh with the teeth **106** of the side brace member **48**. This feature is more clearly illustrated in FIGS. **8** and **9**. In FIG. **8**, the teeth **104**, **106** are separated from one another, whereas in FIG. **9**, the teeth are engaged. The slot **108** can be configured to be any shape so long as the teeth show through the opening created by the slot.

In typical racks of the prior art that include adjustable mounting flanges, it is often difficult to precisely align the mounting flanges such that each of the back flanges are aligned along the same rear plane within the rack with each other and each of the front flanges are aligned along the same front plane within the rack with each other. Without proper alignment, it may be difficult or not possible to mount equipment to the flanges. In prior racks, it is not uncommon to use a tape measure or a similar device to properly align mounting flanges. It is awkward to use such devices in the confined space within a rack. Turning now to FIGS. **8-10**, as will now be described, in at least one embodiment of the present invention, a system and method for accurately positioning the mounting flange **74** at a desired position along the length of the side brace members **48** is provided to enable a person assembling the enclosure **10** to accurately and easily position the mounting flanges **74** within the enclosure.

As shown, a plurality of symbols, each indicated at **110**, are spaced equidistant along the upper edge of each of the side brace members **48**. In addition, the mounting flange **74**, at each clamping assembly **84**, includes three circular openings **112**. The openings **112** are spaced such that at any one time only one symbol appears in only one of the three openings. There are provided four symbols **110**, e.g., a star, a circle, a rectangle and an inverted triangle. Any distinctive symbol may be provided and still fall within the scope of the invention. In one embodiment, the star appears twice on each side brace member and is used to identify an initial, factory set-up position. In this embodiment, the initial factory setting is the position of the mounting flange where the star is visible through the middle opening **112**. The three symbols **110**, other than the star symbol, alternate to form a line of symbols along the length of the side brace member **48**. In one embodiment, the symbols **110** are arranged from left to right in FIG. **8** as follows: inverted triangle, circle, rectangle, inverted triangle, circle, rectangle, etc. The arrangement is such that each symbol **110** can be embossed, stamped, printed on or cut into the side brace member **48** so that each symbol is disposed between adjacent teeth **106** of the side brace member with three teeth between adjacent symbols. The spacing between each opening **112** is equivalent to the space between four teeth.

In FIG. **10**, the star symbol appears in the center opening **112**. The movement of the clamping assembly **84** one tooth length in either direction (left or right) results in the viewing of a symbol **110** in either the left-hand or right-hand opening

112. For example, by moving the clamping assembly **84** one tooth length to the left, the inverted triangle symbol **110** is visible through the right-hand opening **112** (as shown in the drawings). Alternatively, if the clamping assembly **84** is moved one tooth length to the right, the circle symbol **110** is visible through the left-hand opening **112**. The provision of the symbols **110** enables the person assembling the enclosure **10** to accurately position the mounting flange **74** vertically within the enclosure without having to measure its location along the length of each side brace member **48**. Given the length of each mounting flange **74**, e.g., up to seventy-two inches in length, and in some embodiments, even longer, it is relatively easy to align and securely mount the mounting flange in a true, vertical position with the aid of the positioning system. In addition, the positioning system enables the installer to accurately assemble oppositely positioned mounting flanges **74** within the interior of the enclosure **10**, without having to measure the relative position of the mounting flange from its adjacent end wall, e.g., rear door assembly **14**.

As discussed above, the provision of three symbols **110** viewable through one of three openings **112** enables the assembler to easily view and vertically align the mounting flange with respect to the side brace members **48**. Of course, any number of shapes and/or symbols **110** and openings **112** may be provided depending on the size of the teeth **104**, **106**. For example, a positioning system incorporating two symbols with two openings may be suitable for a clamping assembly having relatively large teeth. In this instance, two teeth are positioned between each symbol and three teeth are positioned between each opening. The provision of three openings **112** is particularly desirable with the configuration of the embodiment of the present invention since there is little or no risk that a person assembling the mounting flange **74** will inadvertently align matching symbols **110** due to the fact that it will be obvious that the mounting flanges are not spaced the same distance from the end walls, e.g., the rear door assembly **14**. With the positioning system of an embodiment of the present invention, the spacing between the openings is one tooth length greater than the spacing between the symbols, wherein the number of symbols is equal to the number of teeth between the symbols.

With the mounting flanges **74** assembled, shelving clips (sometimes referred to as a caged nut), indicated at **114** in FIG. **11**A, can be inserted into the openings **80** formed in the other leg portion **78** of the mounting flange to support shelves or even the electrical components provided they are properly configured. It should be understood that electrical components can be mounted at nearly any desired elevation within the enclosure **10** due to the adjustability provided by the plurality of openings **80** formed in the leg portion **78** of the mounting flange **74**. It should also be understood that any number of clips **114** can be provided to accommodate equipment and/or shelves. As shown in FIG. **12**, two mounting flanges **74** are attached to their respective side brace members **48** near the front door assembly **12** of the enclosure **10** and two additional mounting flanges are provided proximate to, but spaced from the rear door assembly **14**. This configuration supports the electrical components near the front door **26** of the enclosure **10**. In addition, this configuration enables cords, cables, etc., which are attached to the backs of the electrical components, to extend within the space defined by the second pair of mounting flanges **74** and the rear door assembly **14**. The flexibility provided by the adjustable mounting flanges allows the flanges to be moved to the back of the enclosure, if it is desired to have more room in the front of the enclosure.

Turning now to FIGS. **11**B and **11**C, there is generally indicated at **301** a data port assembly comprising an insert **303** constructed to hold a connector head **305** having a plurality of data ports, each indicated at **307**. The insert **303** is received within an opening **309**, which is sized to securely fix the insert to the mounting flange **74**. Reference is made to U.S. application Ser. No. 10/901,460, entitled MULTI-PORT CABLING SYSTEM AND METHOD, filed on Jul. 28, 2004, which is assigned to the assignee of the present invention and incorporated herein by reference. An advantage provided by securing the connector head **305** to the mounting flange **74** is that it quickly and efficiently enables the mounting flange to offer multiple data ports **307**. This enables the person assembling the enclosure **10** to connect electrical components to one another and to equipment outside the enclosure.

Referring to FIGS. **12** and **13**, two cable organizers, each generally indicated at **116**, are mounted adjacent to the rear door assembly **14** on the side brace members **48** in a manner similar to the mounting flanges **74**. Each cable organizer **116** is provided for mounting power strips, cables, cords, and otherwise to provide tie-off points to mount objects within the interior of the enclosure **10**. In one embodiment, each cable organizer **116** is fabricated from the same material as the mounting flanges **74** and includes a wall portion **118** and a pair of inwardly projecting flange portions **120**, **122**. A plurality of cutouts **124** are formed (e.g., by stamping or some other similar process) in the wall portion **118** of the cable organizer **116** for tying off cables and for receiving containment brackets. The flange portions **120**, **122** provide strength and rigidity to the cable organizer **116**. As shown in FIG. **12**, the cable organizers **116** are disposed adjacent the rear door assembly **14**; however, it should be understood that the cable organizers may be located within the interior region of the enclosure **10** in any other position suitable for mounting components. For example, cable organizers may be positioned adjacent the front door assembly instead of the rear door assembly, or both.

The cable organizer **116** includes at least one and preferably three (one for each side brace member) clamping assemblies **126** having a clamping bracket **128** which is secured in place by a threaded fastener **130**. Teeth **132** are formed on the upper edge of the clamping bracket **128**, the teeth meshing with the teeth **106** of the side brace member **48** in the same manner as the clamping assembly **84** of the mounting flange **74**. Specifically, the clamping assembly **126** is disposed within a vertical slot **134** formed in the wall portion **118** of the cable organizer **116** and is locked in place by turning the threaded fastener **130** with a tool, e.g., a star wrench, once the teeth **132** of the clamping bracket **128** mate with the teeth **106** of the side brace member **48**. Other fasteners, such as the clamping assembly **84** described above, could alternatively be employed; however, an advantage associated with the clamping assembly **126** is that the threaded fastener **130** is relatively flush with the wall portion **118** of the cable organizer **116** and does not project within the interior region of the enclosure **10**.

As shown in FIG. **13**, two horizontally disposed, elongated slots, each indicated at **136**, are formed in the wall portion **118** of the cable organizer **116** to view the mating of the teeth **132** of the clamping bracket **128** with the teeth **106** of the side brace member **48**. Also formed in the wall portion **118** of the cable organizer **116** are four smaller, circular openings, each indicated at **138**, that are provided for viewing the symbols **110** in a similar manner as the positioning system provided for the mounting flanges **74**.

FIGS. **14** and **15** illustrate the cover or roof **22** of the enclosure **10** of an embodiment of the present invention. The

roof **22** is fabricated from suitable material in one embodiment, and formed with a plurality of generally U-shaped cutouts **140** which provide openings through which cables and cords can be run to equipment in the enclosure **10**. The use of U-shaped cutouts allows an installer to install cables and cords with the roof removed to provide greater access and to later install the roof without disconnecting any of the cables and cords. Another purpose of the roof **22** is for supporting cable troughs, which are secured to the roof through any of the small openings formed in the roof. One such cable trough is disclosed in U.S. patent application Ser. No. 10/284,835, entitled TOOLLESS MOUNTING SYSTEM AND METHOD FOR AN ADJUSTABLE SCALABLE RACK POWER SYSTEM, filed Oct. 31, 2002, which is assigned to the assignee of the present invention and incorporated herein by reference.

The roof **22** is rectangular in shape and formed at one of its ends, end **142**, with a pair of tabs, each indicated at **144**, that are inserted into slots (not shown) formed in the top rail member **28** of the front door assembly **12**. Once inserted, the roof **22** is seated within the frame defined by the top rail members **28**, **40** of the front and rear door assemblies **12**, **14**, respectively. With reference to FIG. **15**A, two spring-loaded pins, each indicated at **146**, are provided at the other end of the roof **22**, the pins being received within respective openings for providing releasable attachment of the roof to the frame. It should be understood that the tabs **144** can be replaced with pins, similar to pins **146**. The pins **146**, in one embodiment, are provided by SouthCo, Inc. under part no. 56-99-421-60, and can be fabricated from steel, aluminum or plastic, for example. It should be understood that any suitable fastener can secure the roof **22** to the frame. Additionally, the roof **22** can be rotated **180** degrees to change the location of the cutouts.

As illustrated in FIG. **15**A, a strip of spring fingers **147**, which are provided along the side of the roof **22**, are preferably fabricated from a conductive, flexible material with a conductive finish, such as electro-plated spring steel, zinc plated beryllium copper, or galvaneel to provide electrical continuity for grounding between the roof **22** and the frame assembly **24**. The spring fingers **147** may be provided by Chomerics of Parker Hannifin Corporation under part no. 81-01-11831-3000.

Referring to FIGS. **16**A and **16**B, there is generally designated at **148** a cutout cover adapted to be installed over one of the cutouts **140** of the roof **22**. As shown, the cutout cover **148** includes a hinge **150** and a plurality of keys, each indicated at **152**, that are suitably attached to the hinge. Each key **152** is pivotable about the hinge **150**, and is releasably attached to the edge of the cutout **140** adjacent the hinge **150** by a pair of retaining clips, each indicated at **156**. FIG. **16**B illustrates the retaining clips **156** engaging the edge of the cutout **140** to secure the key **152** and thus the cutout cover **148** in place. The cutout cover **148** is capable of achieving complete or partial coverage of one of the cutouts **140** by simply opening selective keys **152** of the cutout cover. In one embodiment of the invention, the key can be designed to be torn off the cutout cover.

Turning now to FIGS. **17** and **18**, in another embodiment, in which it is desired to have a greater open area in the top of the enclosure for access into and/or cooling of the interior of the enclosure **10**, two roof bridge members, each indicated at **158**, are provided in the place of the roof **22**. As shown in FIG. **18**, the end of each roof bridge member **158** is provided with a pair of mounting posts **160**, **162** that are adapted to attach the end of the roof bridge member with its respective top rail member of the front and rear door assemblies. Any other type of fastener, such as the spring-loaded pins described above, can be provided for releasably attaching the roof bridge members **158** in place. The roof bridge members **158** are adapted to support cables and cords, and allow maximum access to the interior region of the enclosure **10**. Additionally, the roof bridge members **158** are adapted to support cable troughs on top of the enclosure **10**.

Referring to FIGS. **19** and **20**, each of the side walls **16**, **18** may be enclosed by two side panels, each indicated at **166**, which are releasably attached to the frame assembly **24** of the enclosure **10**. Although two side panels **166** are provided to cover each side of the enclosure **10**, a person having ordinary skill in the art, given the benefit of this disclosure, could employ any number of side panels to enclose the side, e.g., one side panel. The side panels **166** encase the interior region of the enclosure **10**. In addition, multiple enclosures **10** may be placed side-by-side to create a multi-bay enclosure and in this configuration, the side panels provide security and block air flow between the enclosures. Adjacent enclosures that are bayed together may house electrical components that are owned by different entities. Thus, the side panels **166**, when employed, prevent the unwanted access into the interior region of one enclosure by a person accessing the interior region of an adjacent enclosure. In addition, a side panel, or multiple side panels, can be removed to improve air flow through the enclosure.

As shown in FIGS. **20**A and **20**B, the side panel **166** has a bottom edge **170**, which is formed to fit over the top flange **60** of the side brace member **48**. Specifically, the bottom edge **170** is bent so that the side panel rests on the top flange **60** of the side brace member **48**. Referring back to FIGS. **19** and **20**, and to FIGS. **20**C and **20**D, a lock assembly, generally indicated at **172**, is provided along a top edge **174** of the side panel **166** to lock the side panel in place once it is placed over the frame assembly **24**. In one embodiment of the invention, the lock assembly **172** is provided by SouthCo, Inc. under part number A3-99-295-300. The side panels **166** have a conductive finish that mates with a conductive finish on the frame assembly **24** to ground the panels to the frame assembly. In addition, in one embodiment, grounding fingers **173**, such as those provided by Chomerics of Parker Hannifin Corporation under part no. 81-01-11831-3000, may be used on the interface between the side panels and the frame assembly, and are preferably fabricated from a conductive, flexible material with a conductive finish, such as electro-plated spring steel, zinc plated beryllium copper, or galvaneel. The side panels **166**, as with the roof, fits within the frame assembly **24** to provide a flush exterior to more easily accommodate the coupling of multiple enclosures to create a multi-bay enclosure.

Still referring to FIG. **20**, and in addition to FIGS. **21** and **21**A, the bottom of the frame assembly **24** of the enclosure **10** is provided with four casters **176** at the four corners of the enclosure. To remove the weight of the enclosure **10** off of the casters **176**, and to maintain the enclosure in a level position, four leveling feet, each indicated at **178**, are provided at the bottom of the enclosure. Specifically, a support member **180** is attached to the bottom rail member **30** and **42** of the front and rear door assemblies **12**, **14**, respectively, so that it is flush with the bottom edge of the rail member. Each support member **180** has a threaded bore **182** formed therein for receiving a threaded rod **184** of the leveling foot, which is suitably connected (e.g., by a pivotable hinge, such as a ball and socket joint) to a foot portion **186**. As shown, the foot portion **186** is in the shape of a disk that rests upon a generally flat surface, e.g., a floor. In another embodiment, the threaded bores can be formed in the bottom rail member to receive the threaded rods

of the leveling feet. However, the provision of the support member **180** having the leveling feet **178** being provided outside the interior region of the enclosure **10** enables a person installing the enclosure to conveniently level the enclosure even if equipment has already been installed.

FIGS. **21** and **2 1**A illustrate the right-hand leveling foot **178** of the front door assembly. It is understood that the remaining three leveling feet may be constructed in a similar manner. The leveling foot **178** is raised or lowered by turning the threaded rod **184** with a suitable tool, such as a Philips head screw driver. Thus, for example, by turning the threaded rod **184** clockwise, the length in which the foot portion **186** extends from the bottom edge of the support member **180** is increased, and, conversely, by turning the rod counterclockwise, the foot portion is retracted toward the support member. The leveling foot **178** is also provided with a hexagonal portion **186**A (FIG. **21**B) near the base to allow an open-ended wrench to raise or lower the leveling foot. The hexagonal portion **178** may be useful for raising the enclosure **10** off of the casters **176**, or lessening the load on the casters, when the enclosure is loaded with heavy equipment. However, by providing Philips head access at the top of the leveling foot, the foot can be lowered by a drill driver, thus allowing the installer to level the enclosure more quickly and efficiently than in typical enclosures of the prior art, which could only be lowered by using an open-ended wrench. The leveling feet **178** enable the person assembling the enclosure **10** to quickly and efficiently level the enclosure.

Referring to FIGS. **22**, **23** and **23**A, the manner in which the front door **26** may be hinged onto the side rail member **32**, in accordance with one embodiment, will be described in greater detail. As shown, the front door **26** includes a door frame **188** and two hinges, each indicated at **190**, one hinge being located near the top of the door and the other hinge being located near the bottom of the door. It should be understood that more than two hinges can be provided, e.g., three hinges. Although the front door **26** is shown having perforated sheet metal material **192** to allow air flow into and out of the interior region of the enclosure **10**, the perforated sheet metal material could be replaced by any number of similar materials. Further, the enclosure may be provided with a solid or transparent (such as glass or polycarbonate) door panel. A lock assembly **194** is provided for locking the front door **26**, thereby preventing unwanted access into the interior region of the enclosure. The lock assembly **194** will be described in greater detail below.

With reference to FIG. **23**, each hinge **190** comprises a bracket **196** mounted on the side rail member of the door assembly by a pair of threaded fasteners **198**, e.g., machine screws. Each bracket **196** has an upwardly projecting pin portion **200**, which is spring-loaded and moveable to a retracted position for removing the door **26** without lifting the door off the hinges **190** (see FIG. **23**A). Each pin portion **200** is received within a respective barrel portion **202**, which is also suitably mounted on the door frame **188**, e.g., by welding or suitable fastening. It should be understood that the pin portions can project downwardly instead of upwardly, and, in the present embodiment, the pin portions project both up and down to allow the hinge to be reversible (left-hand versus right-hand hinging). The bracket **196** can be mounted on the door, and barrel portions can be mounted on the side rail member of the door assembly, and still fall within the scope of the present invention. The arrangement is such that both of the barrel portions **202** of the door frame **188** are slipped over their respective pin portions **200** to install the door on the side rail member **32**. The door **26**, the door frame **188** and the hinges **190** are constructed so that the door swings open a maximum of **120** degrees to prevent the door from engaging an adjacent enclosure. Also, the pin portion **200** and the barrel portion **202** are constructed and arranged to prevent the door **26** from being removed from the hinge **190** when the door is in a closed position. As shown in FIG. **23**A, the pin portion **200** is constructed to receive the barrel portion **202** when the door **26** is oriented in an open position so that the barrel portion slips over the pin portion. When closing the door **26**, the pin portion **200** prevents the barrel portion **202** from being removed thereby locking the door in place.

In an embodiment of the present invention, the door hinges **190** are reversible and may be mounted on the other side rail member, e.g., right side rail member **34**, by simply unscrewing the threaded fasteners **198**, removing the brackets **196**, and mounting the brackets on the other rail member with the threaded fasteners. The barrel portions **202** of the front door frame **188** are capable of receiving the pin portions **200** when mounting the door in a reversed position. Thus, it should be observed that the front door assembly **12** of the present invention is capable of being easily removed off of the hinges **190** without the aid of tools by simply opening the door and lifting the door off of the hinge. It should also be observed that the front door assembly of an embodiment of the invention is reversible to accommodate instances in which it is desirable to have the hinge on the right side rail member **34**. It is important to note that the hinge and the door are constructed and arranged to interact so that the door cannot be lifted off its hinges when the door is closed.

Also illustrated in FIG. **23** is a baying bracket **204**, which is used to connect adjacent enclosures **10** to each other. Specifically, the baying bracket **204** is capable of swinging out perpendicularly from the side rail member, e.g., left side rail member **32**, the baying bracket having two openings, each indicated at **206**, formed therein for receiving threaded fasteners to thereby attach an adjacent enclosure within predetermined industry standards.

FIG. **24** illustrates the rear door assembly **14** of an embodiment of the present invention. As shown, the rear doors **36**, **38** are mounted on their respective side rail members **44**, **46** in the same manner as the front door, e.g., with hinges **190**. It should be understood that the rear door assembly **14** can be provided with a single door (as with the front door assembly), and that the front door **26** can be provided with a pair of doors (as with the rear door assembly). Alternatively, the rear door assembly **14** can be replaced with a solid panel to enclose the back end of the enclosure **10**. Another lock assembly **194** is further provided for locking the rear doors.

Specifically, the lock assembly **194** of an embodiment of the present invention is shown with reference to FIGS. **25** and **26**. Each lock assembly **194** includes a front plate **208**, a lock cylinder **210**, a lock mechanism **212** and a latch **214**. The lock assembly **194** is suitably attached by threaded fasteners (not shown) from the interior region of the enclosure **10** to the frame of the door in a position in which the latch **214**, when in a locked position, prevent the opening of the door. In one embodiment, the lock assembly **194** may be purchased from SouthCo, Inc. under model nos. CN-29-1-300 (for the front door assembly **12**) and CN-29-2-300 (for the rear door assembly **14**). In one embodiment of the invention, the doors can be spring loaded so that they open and close with fewer operations by the user.

Turning now to FIGS. **27** and **27**A, there is generally indicated at **216** an electrical connector of an embodiment of the present invention designed to make an electrical connection between a component, such as a side panel of an enclosure and a cable or wire **217** (FIG. **27**A), e.g., for grounding purposes. As shown, the electrical connector **216** comprises a

generally U-shaped body **218** having a pair of oppositely extending flanges **220**, **222**, which are adapted to be welded onto a planar surface (FIG. **27**A), e.g., a wall **16** or **18** of the enclosure **10**. Formed between the flanges **220**, **222**, and integrally formed with the body **218**, is a tab **224** which extends along the same plane as the U-shaped body, the tab being connected to the U-shaped body by connector portion **226**. When mounted on the planar surface, the tab **224** is spaced from the planar surface. The tab **224** is constructed and arranged to receive the cable **217**. Specifically, the cable is slipped over the outer surface of the tab. An opening **228** formed in the tab **224** is adapted to further secure the cable to the tab. In the present embodiment, the electrical connector **216** is formed from a blank that is manipulated to achieve the form illustrated in the drawings, e.g., by cutting, bending, etc., but a similar result could be achieved with a casting of the connector.

The arrangement is such that the U-shaped body **218** of the electrical connector **216** protects the tab **224** during use. As shown, the U-shaped body **218** provides a protective shield around the tab **224** so that the electrical connection with the cable **217** is disposed between and thereby protected by the planar surface and the U-shaped body. Prior art electrical connectors expose the tab so that the tab and/or the cable are prone to be torn off or broken during use.

FIG. **28** illustrates an electrical connector, generally indicated at **230**, of another embodiment. As shown, the electrical connector is similarly constructed as electrical connector **216**, except for the provision of an opening **232** formed in one of the flanges, e.g., flange **222** as shown, the opening being sized for receiving a threaded fastener or rivet (not shown) therein, and a positioning tab **234** formed in place of the other flange, e.g., flange **220**. The arrangement is such that the positioning tab **234** is received within a slotted opening formed in a wall or panel of the enclosure **10**, for example, while the flange **222** is secured to the wall via a threaded fastener, e.g., a machine screw or rivet.

As described above, an advantage of embodiments of enclosures of the present invention is the ability of the enclosures to be quickly and easily assembled and disassembled. Specifically, the front and rear door assemblies **12**, **14** and six side brace members **48** can be broken down and packaged together in the form of a kit. Such a kit **236** is illustrated in FIG. **29**. The side panels **166** and roof **22** may be provided separately, or these components as well as the cable organizer **116** and other components of the enclosure **10** can be packaged with the side panels and roof in one kit. Thus, it will be observed that a single kit **236** is configurable for quick and easy assembly to achieve shown embodiments of an enclosure.

As shown in FIG. **29**, the door assemblies **12**, **14** are positioned to overlie one another along a common plane. The roof **22**, side brace members **48**, mounting flanges **74** and cable organizers **116** are positioned between the front and rear door assemblies **12**, **14**, respectively. Even without the side panels **266**, the components provided by the kit **236** enable the person assembling the enclosure **10** to complete the frame assembly **24**. The other components can be assembled at another time. The use of kits for the enclosures **10** achieves a compact configuration suitable for transport and/or storage.

Typical racks are transported in an assembled condition. The frame of a typical rack is of welded construction and is not easily arranged or disassembled. This results in expensive shipping costs due to the large size of the enclosures. As shown in FIG. **30**, in accordance with one embodiment, a transport crate, generally indicated at **238**, is configured to receive a plurality of kits **236**. The transport crate **238** is a box-like structure having dimensions of 73 inches, 33 inches and 55 inches. The transport crate **238** illustrated in FIG. **30** is configured to transport five kits **236**. Thus, since five kits **236** can be contained within a single transport crate **238**, the size and cost of shipping enclosures are greatly reduced. Of course, the transport crate **238** can be sized to receive any number of kits **236**, as well as kits having different sizes. A plurality of widthwise dividers **240** are provided within the interior region of the transport crate **238** to separate the kits **236** from one another during use. The dividers **240** define separate compartments to prevent the kits **238** from wearing against each other during transport, thereby protecting the exterior finish of the components of the kit. In addition, the dividers **240** maintain these components organized so that each kit **238** can be safely removed without the risk of components spilling out of the crate.

The transport crate **238** may be fabricated from wood, which can be reinforced with metal brackets to further stabilize the crate. Specifically, the outer walls of the transport crate **238** can be fabricated from plywood, engineered cardboard or plastic. The bottom of the transport crate is constructed similar to a pallet to allow a fork truck or other similar moving machine engage, lift and move the transport crate. The dividers **240** can be constructed out of wood, cardboard, plastic or foam, for example.

Referring to FIG. **31**, a cable organizer, generally indicated at **116**, is illustrated separate from the enclosure **10**. As discussed above, the cable organizer **116** may be mounted on the side brace members **48**, for example, within the interior region of the enclosure **10**. As shown, and as discussed above, the cable organizer **116** includes the wall portion **118** and the pair of inwardly projecting flange portions **120**, **122**. In addition to cutouts **124**, which may be used to tie off cables and to receive containment brackets, for example, the wall portion **118** is formed with a plurality of openings **242** formed along opposite edges of the wall portion adjacent respective flange portions **120**, **122**. The openings **242** are arranged generally in the same manner as openings **80** of mounting flange **74**, and are provided, among other things, for mounting the cable organizer to the side brace members **48** of the enclosure **10** and for mounting components onto the cable organizer.

Generally indicated at **300** in FIG. **31** is a cable containment bracket of an embodiment of the invention, which is designed to be releasably attached to the cable organizer **116** in a manner set forth in more detail below. As shown in FIGS. **31** and **32**, the bracket **300** is generally rectangular in construction, having a housing with a back wall **302**, two side walls **304**, **306**, and a front wall or door **308** pivotally attached to one of the side walls, e.g., side wall **306**. As shown, the width of the cable containment bracket **300**, as defined by the back wall **302** and the front door **308**, generally corresponds to the width of the cable organizer **116**. The width of the housing of the cable containment bracket **300**, as viewed in FIGS. **31** and **32**,is longer than the height of the housing cable containment bracket,Stated another way, the back wall **302** of the housing has a width defined by the distance between the side walls **304**, **306** that is greater than the height defined by the distance between the top and the bottom of the back wall. The arrangement is such that cables extend through the cable containment bracket **300** by an open top and an open bottom of the cable containment bracket. Once inserted into the cable containment bracket **300**, the front door **308** may be closed to protect the cables. In one embodiment, the bracket **300** is fabricated from any suitable lightweight, rigid material, such as, but not limited to, plastic, steel or aluminum. The arrangement is such that multiple brackets, when mounted on the cable organizer **116** (FIG. **31**), enable bundled cables **310**, for

example, to be contained within the brackets, with the front doors **308** providing access to the bundled cables. Although bundled cables are shown and described herein, it should be understood that the cable containment bracket may be employed to house and protect any number of products, including but not limited to loose wires, cords, etc. Thus, unlike prior cable fasteners, the cable containment bracket **300** of an embodiment of the invention, when used with other brackets, is particularly adapted to completely encase and protect its contents, e.g., bundled cables, while enabling easy access to its contents via the front door **308**.

The back wall **302** and the side walls **304**, **306** may be fabricated from a single sheet of material manipulated to achieve the configuration illustrated in the drawings, or in an alternate embodiment from three separate sheets of metal joined together. The front door **308** is hingedly attached to side wall **306** by means of two barrel portions **312**, **314** formed on the side wall. The barrel portions **312**, **314** are configured to receive oppositely projecting pins **316**, **318**, respectively, formed on the front door **308** as illustrated in FIG. **33**. This construction enables the front door **308** to swing from a closed position (FIG. **32**) to an open position (FIG. **33**) about its hinged connection to the side wall **306**.

With reference to FIGS. **32** and **34**, the front door **308** includes a door latch member **320** fabricated from resilient but strong material, e.g., spring steel. The door latch member **320** is constructed so that a bend portion **322** of the door latch member engages an edge **324** of the side wall **304** to enable a free end **326** of the door latch member to flex inwardly. Once the free end **326** of the door latch member **320** clears the edge **324** of the side wall **304**, the door latch member by virtue of its resilient construction flexes or springs back to its relaxed configuration to enter into a recess **328** formed in the side wall. A rounded edge **330** of the door latch member **320** engages the edge **324** to prevent the front door **308** from opening. The front door **308** may be opened by pressing or flexing the door latch member **320** so that the rounded edge **330** disengages or clears the edge **324** to enable the front door to swing past the edge of the side wall **304**.

Turning now to FIG. **35**, the cable containment bracket **300** of an embodiment of the invention may be attached to the cable organizer **116** without the use of tools, otherwise known as "toolless mounting." As shown, the side walls **304**, **306** include inserts **332**, **334**, respectively. Each insert **332**, **334** is configured with two latches, each latch being designated **336** in the drawings. The inserts **332**, **334** may be fabricated from spring steel as well. Each latch **336** is capable of being releasably inserted within respective openings **242** in the manner shown in FIG. **35**. Although FIG. **35** illustrates four latches **336**- two latches **336** with side wall **304** and two latches **336** with side wall **306**, with each pair of latches being spaced from one another the same distance as openings **242**, it should be noted that the cable containment bracket **300** can be mounted with fewer or more latches and still fall within the scope of the present invention. For example, the cable containment bracket could be adequately supported by two latches provided on opposite sides of the bracket or via toolless pegs in cutouts **124**.

As shown, each latch **336** has a rounded portion **338** adapted to engage the wall portion **118** of the cable organizer **116** when inserting the latch **336** into the opening **242** to mount the cable containment bracket **300** on the cable organizer. The rounded portion **338** of the latch **336** is adapted to flex so that upon clearing an edge of the opening **242**, an end **340** of the latch engages the wall portion **118** to secure the latch and the cable containment bracket in place. By flexing the rounded portion **338** so that the end **340** clears the edge of the opening **242**, the latch **336** can be removed from the wall portion **118** of the cable organizer **116** to remove the cable containment bracket from the cable organizer.

In operation, and with reference back to FIG. **31**, it is appreciated that the cable containment bracket **300** of an embodiment of the invention may be employed within the interior region of the enclosure **10** to protect bundled cables. The front door **308** of each cable containment bracket enables the bundled cables, for example, to be selectively accessed along the length of the bundled cables by opening one or more of the front doors. As described herein, the front doors may be easily manipulated by hand, without the aid of tools, by pressing or otherwise manipulating their respective latches. Also, the cable containment brackets **300** may be easily employed within the enclosure by inserting the latches **336** of the cable containment brackets into respective openings of the cable organizer. Thus, multiple cable containment brackets may be installed quickly, without having to resort to using tools.

Turning now to FIG. **36**, a cable containment bracket **350** of another embodiment is shown. Cable containment bracket **350** is similar to bracket **300** except for the provision of a door latch assembly **352** in place of door latch member **326** (see FIG. **34**). The door latch assembly **352** is mounted on the front door **308**, and includes a pair of oppositely projecting push buttons, each indicated at **354**, that can be engaged or pressed toward one another to enable the retraction of detents (not shown) of a member **356**, which projects from the other side of the front door. The latch assembly **352** may be of the type sold by SouthCo, Inc. under model no. 60-10-101-12. The arrangement is such that when closing the front door **308** and thereby inserting the member **356** into an opening **358** formed in a latch plate **360** secured to or integrally formed with side wall **306**, the detents of the member are released or extend outwardly to engage the latch plate to prevent the door from opening. The door is opened by pressing the buttons to enable the retraction of the detents, thereby permitting its passage of the member **356** back through the opening of the latch plate **360**.

Although FIGS. **31-36** illustrate two embodiments of the present invention, various alterations, modifications and improvements are further contemplated. For example, the provision of the back wall **302** is not necessary since the bundled cables **310** are protected on one side thereof by a wall of the enclosure **10** and/or the cable organizer **116**. In addition, although the containment brackets **300**, **350** are shown to be generally rectangular structures, it is contemplated that the structures may embody other configurations. For example, the housing or body of the containment bracket may be cylindrical-shaped.

In addition, in another embodiment, dividers may be inserted into the interior region of the containment bracket **300** or **350** to separate cables or bundles of cables from one another. For example, dividers attached to either the back wall **302** and/or the side walls **304**, **306** may be disposed within the bracket along a vertical plane. Alternatively, dividers attached along a horizontal plane having openings formed therein may be further provided.

FIGS. **31** and **35** illustrate the containment bracket **300** secured to the cable organizer **116** via openings **242**. In another embodiment of the present invention, it should be understood that the containment brackets may alternatively be configured to be secured to the cable organizer via cutouts **124**. Specifically, the latches **336** may be positioned to extend into the cutouts **124** to secure the containment bracket to the cable organizer.

Furthermore, although the door **308** is shown to be attached to the side wall **306** by a hinge (i.e., barrel portions **312**, **314** and pin portions **316**, **318**), other configurations may be employed. For example, in another embodiment, the door may be releasably secured to the side walls **306**, **308** by a pair of latch members provided on opposite sides of the door so that the door may be completely removed from the remainder of the containment bracket.

In another embodiment, the door latch may be designed with a lock to secure the bundled cables from unwanted access. Also, as described herein, every containment bracket includes a front door to access the interior region of the bracket. In one embodiment, the containment bracket may include a permanently affixed front door (i.e., a front wall). Thus, multiple containment brackets may be configured to create a solid encasement around the bundled cables with brackets having hinged or removable front doors being interstitially spaced between the solid brackets to allow access to the cables.

Having thus described at least one embodiment of the present invention, various alternations, modifications and improvements will readily occur to those skilled in the art. Such alterations, modifications and improvements are intended to be within the scope and spirit of the invention. Accordingly, the foregoing description is by way of example only and is not intended to be limiting. The invention's limit is defined only in the following claims and equivalents thereto.

For example, the front and rear door assemblies **22**, **24** can be configured using components that require assembly. In addition, the number of side brace members can be modified to reflect changes in the size of the enclosure or changes in strength requirements.

With respect to the connectors **50**, it should be understood that each connector could be modified and still fall within the scope of the present invention. For example, the provision of the lower tab having the boss that is received within the opening of the side brace, while providing an added level of stability to the connection, is not required. Similarly, the provision of the finger that is hooked over and secured to the threaded fastener can be modified or deleted as required. One key feature of at least one embodiment of the connector **50** is that it enables the quick and efficient connection of a side brace member to the frame of the front or rear door assembly.

With respect to the mounting flanges, their construction as L-shaped members can be modified to support different configurations. The mounting flanges **74** are particularly adapted to support shelves and/or electronic components at their corners. In one embodiment it may be desirable for the mounting flange to lie flat along the plane of their respective side walls. This configuration would allow more than two mounting flanges along each side of the shelf and/or electronic component. Also, it is not necessary that the mounting flanges run the entire vertical height of the enclosure. Shorter flanges can be employed to allow some equipment to be mounted at different depths than others.

With respect to the clamping assemblies **84**, as described above, other latching mechanisms can be utilized in place of the latch member. For example, a thumb screw that tightens the clamping member, or some other similar mechanical device, may be implemented. One advantage with the clamping assembly of at least one embodiment of the present invention is that the clamping assembly can quickly and efficiently position and lock the mounting flange in place without the use of tools. The clamping assembly can be used by simply unlocking the latch member, raising the clamping assembly within the slot so that the teeth of the clamping member mesh with the teeth of the side brace member and locking the latch member. It should also be noted that the provision of teeth is not required. For example, an interlocking member may be provided along the length of the side brace member, the interlocking member engaging the clamping assembly to hold the mounting flange in place.

With respect to the positioning system, as mentioned above, depending on the size of the teeth (i.e., the incremental movement of the mounting flange along the side brace member), it may be desirable to provide more or less than three symbols and three openings. For example, in another embodiment, there may be provided four separate symbols, each etched or stamped or cut in the side brace member so that the symbols are provided in a sequence occurring every fourth symbol, and four openings in which a symbol appears in only one opening. In such an embodiment, the spacing between symbols is four teeth and the spacing between openings is five teeth. Thus, by moving the mounting flange one tooth in either direction (left or right), a different symbol appears in a different window. Although shown and described with a clamping assembly having teeth, the positioning system can be used with an assembly that does not enable the incremental movement of the mounting flange and still fall within the scope of the present invention.

With respect to the cable organizers **116**, one alternate embodiment is to integrally form the cable organizer feature with the frame of the rear door assembly, for example. Also, the provision of a cable organizer having another form of clamping assembly to secure the cable organizer to the side brace member is further contemplated herein. The clamping assembly **126** enables an installer to quickly and efficiently secure it to the side brace members. Also, a different pattern of cutouts can be further implemented.

With respect to the roof **22**, the provision of another manner of attaching the roof to the frame assembly is contemplated. For example, mechanical fasteners, such as the threaded fasteners used to secure the bridge members, may be provided. In addition, the number and placement of the cutouts can be modified and fall within the scope of the present invention.

With respect to the cutout cover **148**, the shape and size of the cutout cover can be modified to cover a cutout formed in the roof. In addition, the size and number of keys can be modified to vary the manner in which the cutout is covered. Also, the manner in which adjacent keys are releasably attached to one another can be varied. For example, each key may be provided with an interlocking member that releasably connects with an interlocking member of its adjacent key.

With respect to the side panels **166**, it may be desirable to exclude the side panels so that the electronic components can be easily accessed from the side of the enclosure. Also, as described above, the area defining the side of the enclosure can be covered by any number of side panels.

With respect to the leveling feet **178**, although the feet are shown to be mounted on the support members **180**, these feet can be mounted on the bottom rail members **30**, **42** and still fall within the scope of the invention. The advantage to mounting the leveling feet **178** on the support members **180** is that the leveling feet can be accessed outside the enclosure **10** without having to open the doors **26** and **36**, **38**.

With reference to the door assemblies, it is not necessary for the enclosure to include doors. The enclosure can simply consist of two frames connected by any number of side brace members and still fall within the scope of the present invention.

With reference to the hinges **190** that hinge the doors (e.g., door **26**) on their respective door frames, the hinges can be

releasably mounted on the door frames in any suitable manner. One advantage associated with the hinges disclosed herein is their ability to mount the door on either side of the door frame.

With reference to the electrical connectors **216**, **230**, these devices are designed to be conveniently secured to the enclosure in any number of locations within the interior of the enclosure or on the exterior of the enclosure. One advantage associated with the electrical connectors is their ability to protect the connection of the wire or cable to the electrical connector, yet enable quick connection and release of the mating connector.

With reference to the kit **236** and transport crate **238**, the provision of multiple kits provided in one crate enables the kits to be economically stored and shipped thereby saving storage space and transportation costs. As described herein, the kits are easy to assembly and provide the ability to disassemble and store the enclosures when they are not in use or when they are required to be moved.

With respect to the cable containment brackets **300**, **350**, the provision of a bracket capable of being installed by hand and without the aid of tools enables multiple brackets to be installed within the enclosure **10** quickly and efficiently. Also, the provision of front doors enable quick and convenient access to the contents of the cable containment brackets (e.g., bundled cables) without having to completely remove or otherwise disassemble the brackets.

What is claimed is:

1. An enclosure for housing electronic components, the enclosure comprising:

a frame assembly comprising a plurality of frame members defining an interior region of the enclosure;

a support attached to at least one frame member within the interior region of the enclosure;

a containment bracket for encasing a cable or wire to the support, the containment bracket comprising

a housing having an interior region, the housing having a back wall, a first side wall extending from one side of the back wall, a second side wall extending from an opposite side of the back wall, and open top and an open bottom, the housing being configured to receive at least one cable or wire so that the at least one cable or wire extends from the open top through to the open bottom, the housing further being constructed such that the back wall of the housing has a width defined by the distance between the first and second side walls that is greater than the height defined by the distance between the open top and the open bottom,

at least one latch coupled to the housing, the at least one latch being constructed and arranged to be releasably secured to the enclosure without the aid of tools, and

a door coupled to the housing to access the interior region of the housing; and

at least one electronic component support member releasably mounted on the at least one frame member.

2. The enclosure of claim **1**, further comprising at least one clamping assembly to releasably clamp the at least one electronic component support member to the at least one frame member.

3. An enclosure for housing electronic components, the enclosure comprising:

a frame assembly comprising a plurality of frame members defining an interior region of the enclosure;

a support attached to at least one frame member within the interior region of the enclosure; and

a containment bracket for encasing a cable or wire to the support, the containment bracket comprising

a housing having an interior region, the housing having a back wall, a first side wall extending from one side of the back wall, a second side wall extending from an opposite side of the back wall, and open top and an open bottom, the housing being configured to receive at least one cable or wire so that the at least one cable or wire extends from the open top through to the open bottom, the housing further being constructed such that the back wall of the housing has a width defined by the distance between the first and second side walls that is greater than the height defined by the distance between the open top and the open bottom,

at least one latch coupled to the housing, the at least one latch being constructed and arranged to be releasably secured to the enclosure without the aid of tools, and

a door coupled to the housing to access the interior region of the housing,

wherein the support comprises at least one cable organizer releasably mounted on the at least one frame member within an interior region of the housing of the enclosure, the cable organizer being adapted to support the cable containment bracket, and

wherein the at least one cable organizer comprises a clamping assembly to releasably clamp the cable organizer to the at least one frame member.

4. A containment bracket assembly for encasing a cable or wire within an enclosure designed to house electrical components, the containment bracket assembly comprising:

a support; and

a containment bracket comprising

a housing having an interior region, the housing including a back wall, a first side wall extending from one side of the back wall, a second side wall extending from an opposite side of the back wall, an open top and an open bottom, the housing being configured to receive at least one cable or wire so that the at least one cable or wire extends from the open top through to the open bottom, the housing further being constructed such that the back wall of the housing has a width defined by the distance between the first and second side walls that is greater than the height defined by the distance between the open top and the open bottom,

at least one latch coupled to the housing, the at least one latch being constructed and arranged to be releasably secured to the support without the aid of tools, and a door coupled to the housing to access the interior region of the housing,

wherein the support comprises at least one cable organizer having an elongate body with a plurality of openings formed therein, the at least one latch being configured to enter into one of the plurality of openings, and

wherein the at least one cable organizer comprises a clamping assembly to releasably clamp the cable organizer to an element of the enclosure.

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